JUN 20 1912

JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

Entered as second class matter May 7, 1906, at the Post Office at San Francisco Cal., under the act of Congress March 3, 1879.

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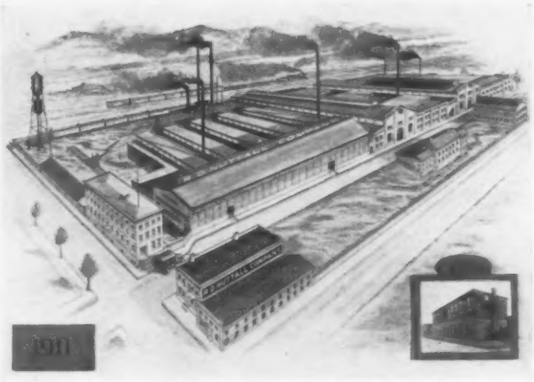

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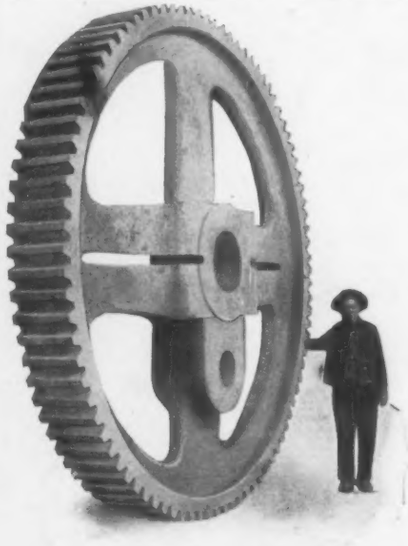

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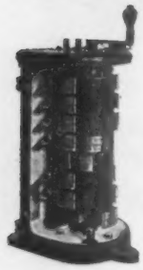

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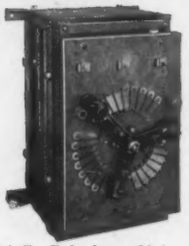

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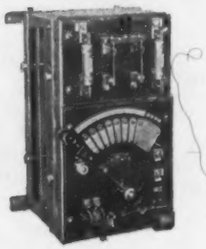

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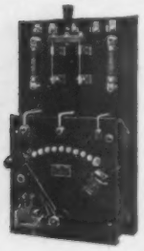

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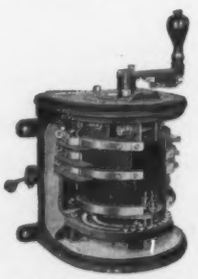

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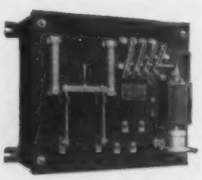

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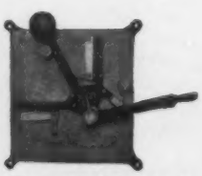

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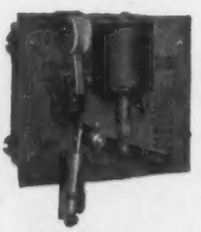

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JOURNAL OF ELECTRICITY
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VOLUME XXVIII SAN FRANCISCO, JUNE 15, 1912 NUMBER 24

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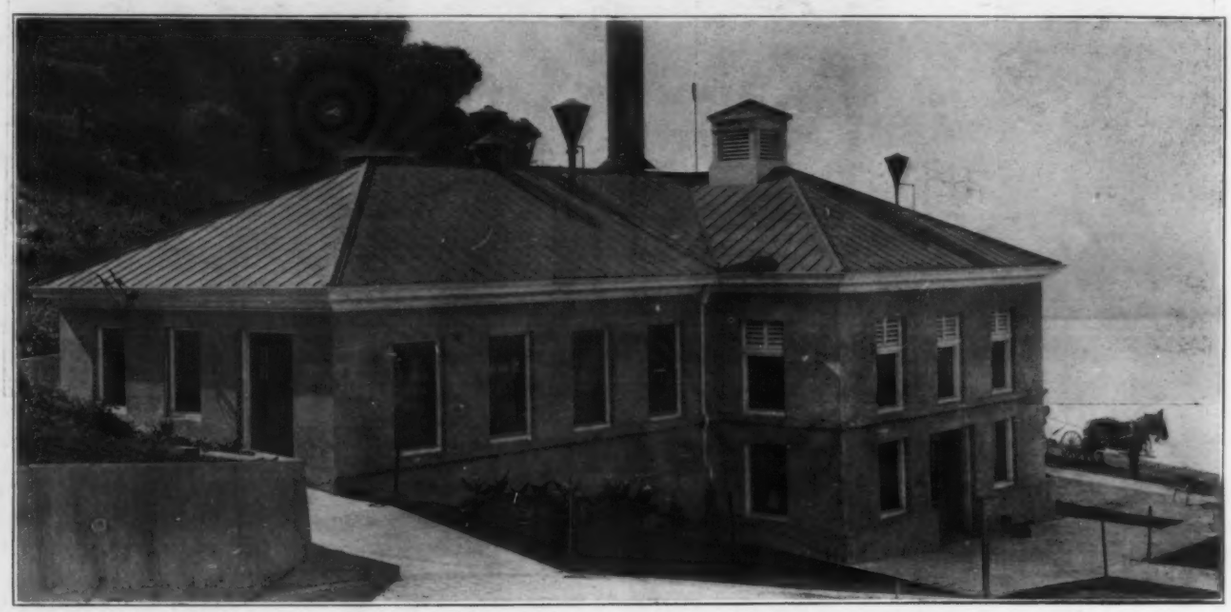
ANGEL ISLAND POWER PLANT

Some years ago the Federal Government assumed control of all islands in San Francisco Bay. Several of these have now become important stations for government work. For instance, upon Goat Island is to be found the United States training school with its beautiful equipment, the island of Alcatraz cuts the horizon with its prison walls, while Angel Island is maintained as a detention port and also for quarantine purposes. So extensive have become these various activities of the government it has been found necessary to install on every island a power plant for the supply of heat and light.



Power Plant at Angel Island

The Pacific Gas & Electric Company is now engaged in constructing a cable connection with Angel Island in order to supply to the government electrical energy for the quarantine station. However, as steam heat is necessary for the detention station, it is doubtful if the power plant will be done away with.

At the detention station on Angel Island is a thoroughly modern power plant installation. The building is composed of reinforced concrete and is shapely in appearance both in structure and surroundings. Within the building is to be found two 75 h.p. Stirling boilers equipped with the Witt fuel system of furnaces and burners, a single burner being supplied for each boiler. The steam generated by these boilers is used to heat the main buildings which are four in number, and in addition, to drive two reciprocating units in the adjacent room, which generate the electrical supply for the detention station.

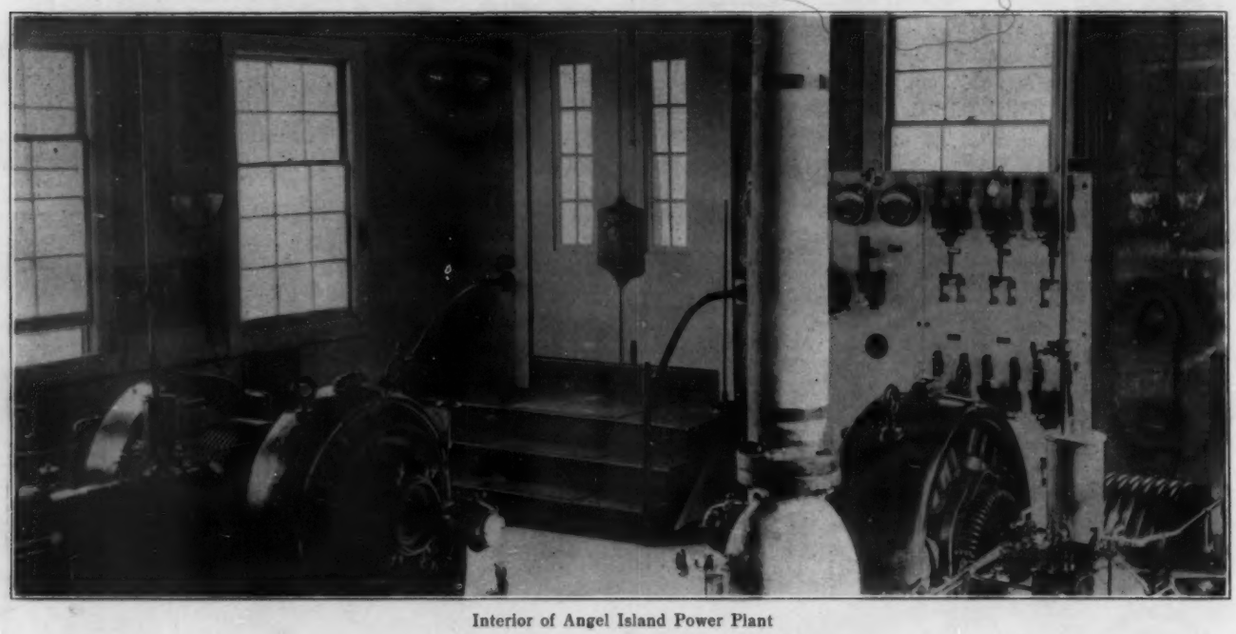
The reciprocating units are situated in a concrete room 30 x 40 ft. In this room is to be found a 35 kw., 125 volt, 280 ampere, 300 r.p.m., direct current Westinghouse generator directly connected to a McEwen tandem compound engine, which operates with a 10-inch stroke. The two cylinders of this engine are 6½ and 13 in. bore, respectively. There is also held in reserve for emergency conditions a 50 kw., 125 volt, 400 ampere, 300 r.p.m. direct current Westinghouse generator directly connected to a 100 h.p.

McEwen tandem compound engine, which operates with a 12 in. stroke and has cylinders of 7 and 14 in. bore, respectively.

The oiling system for these reciprocating units is homemade but effective. It consists of a steel tank, 2 ft. in diameter and 3½ ft. high, situated 15 ft. above the engine plane. It operates by a gravity system and is returned to the tank by means of a hand pump.

The ammeters and voltmeters upon the switchboard are manufactured by the International Electric Meter Company of Chicago, the recording voltmeter is of the General Electric type, while the remaining complete switchboard equipment is furnished by the Westinghouse Electric & Manufacturing Company.

The condensers, which maintain a vacuum of from 27 to 28 inches, are placed on a lower deck in the main engine room. This lower deck is of concrete construction on all sides. Immediately above these condensers are to be found the vacuum gauges under which each condenser operates, and also a pressure gauge which indicates the pressure of the steam being supplied to the boilers by the reciprocating units.



Interior of Angel Island Power Plant

The hot well for the waters from the condenser is a square steel tank, 5 x 2½ x 4½ ft., in the rear of the boiler installation. A Blake 10 x 8½ x 10 inch duplex pump is used to force the circulating water from the bay through the condensers. This pump is also held in reserve for flushing the sewers and in case of fire in the main buildings. A 6 x 4 x 6 in. Blake pump and a 4½ x 3 x 4 in. Fairbanks, Morse pump are utilized in supplying the feed water to the boilers. Two 3½ x 2¼ x 4 in. duplex Worthington pumps are used in forcing the oil to the burners. A National feed water heater is used in the water supply. The oil for the furnaces is passed through a Worthington oil meter in its course to the burners and as a rule but 1100 gallons of oil are consumed in the 24-hour run.

THE ALL ELECTRIC INTERLOCKING SYSTEM[1]

BY P. J. OST.

The oldest form of interlocking is what is known as the mechanical type in which the power is manual, being transmitted by pipe, rods or wires. This system is satisfactory where the number of functions is not great and the traffic not heavy. However, with the increase of transportation demands the plants began to grow to such size and to require so many men to operate them that some form of power operation became imperative.

This demand was cared for by various systems, the majority of them employing compressed air for the transmission of power, until the year 1891, when John D. Taylor brought out his first electric device. It was only after years of work and study that the first installation was made on the Baltimore, Ohio & Southwestern at East Norwood, Ohio. This plant was built in the Baltimore & Ohio shops. That Mr. Taylor had planned well is indicated by the fact that to this day his ideas, incorporated in his first plant, are the basis of most electric interlocking designs.

In all interlocking work, as the name implies, the levers are so inter-connected as to prevent aligning two conflicting routes at the same time, also all switch and derail levers are so inter-locked with signal levers that it is impossible to give a proceed signal until the route is complete, neither may a route be changed with a signal in the proceed position.

A motor is used for each switch, derail and signal, except low signals, called dwarf signals, all of which until recently have operated by a solenoid.

In mechanical operation the force required to move a lever served in most cases as an indication that the movement had actually taken place. However, when power came into use the lever man could not, as it

[1]Paper presented before San Francisco Section A. I. E. E., May 24, 1912.

were, feel his plant, so some arrangement had to be made whereby he was advised of the proper operation of the various parts in response to a lever movement. This feature is known as indication and should only be given on the completion of a movement.

With the various types of pneumatic plants this indication was very easily given by the opening or closing of a battery circuit through contacts actuated by the mechanism, but with the advent of electricity for power a cross between two wires might give a false indication. In order to make the indication different from and independent of the power current a means of using the counter electro motive force generated by the motor for indication was devised, for the more important operations, namely, both normal and reverse movements of all rail point operating machines and for the movement of a signal from "proceed" to "stop." With solenoid dwarf signals the indication is secured by the use of power current over a separate wire.

In order that the leverman will respect the indication he is required to operate the levers in two movements. The first part of the stroke effects a preliminary locking of all routes in conflict with the new position of the lever, at the same time making the necessary electrical connections to secure the desired action. In this position the lever rests against the indication stop. When an indication from the function is received the stop is removed, allowing the completion of the lever stroke, permitting any subsequent lever movements to be made to set up a route. In this way the operator must receive an indication from all switches and derails in a route before being able to give the proceed signal. This delay is, however, very slight, in a majority of cases being less than two seconds.

The wiring is divided into three classes, controls, indications and commons, the names describing their functions. Switch machines have two control wires which serve also as indication wires. While one of the pair is control the other is indication, and vice versa. High signals have one control only, which acts as indicator wire also. Solenoid dwarfs have one control and one indication wire. Main common or the wire for power return reaches each function and in later installation is tapped to the indication bus, making it serve as indication common also; in older plants a separate common wire was used.

Control wires receive their power through the lever contacts and a fuse from the switch or signal bus mounted on a slate board at the rear of the interlocking machine. Main common goes to the negative terminal on the power operating panel.

In addition to the interlocking machine, and the switch and signal mechanisms, there are generally installed a 110 volt storage battery, the size depending on the plant, with a distributing switchboard, together with the necessary charging arrangements and charging switchboards. At isolated points it is customary to use a gasoline engine generator set for charging, while where electric power is available advantage is generally taken of it.

It will be of interest now to follow the operation of a switch or derail movement. The switch bus on the machine is connected to the positive side of the battery through one pole of a double pole circuit breaker mounted on the operating or distribution panel the signal bus being connected through the other pole. Each lever is provided with a separate fused tap off the bus bars. Under each switch lever are mounted two pairs of magnet coils. These magnets are mounted vertically one above the other, the poles facing, and are provided with a common armature. The lower coils are known as safety magnets while the upper ones are the indication magnets. Through the safety magnet must go all current received from the bus bar for the particular function to which it is attached. From the safety magnets the circuit leads to a pair of selector magnets where it divides, one connection going to front lever contacts for the reverse control and one to the rear lever contacts for the normal control wire. These lever contacts are placed in two groups, each group consisting of four fingers or brushes secured to a stationary block of insulating material. The movable part is another block of insulating material carrying two contact strips for bridging the fingers. This movable part is attached to the lever and travels with it. In the normal position of the lever, normal control wire is connected to the switch bus bar by the strip bridging the two fingers, also reverse control wire is connected to the indication bus through the other strip and the indication magnet. In the reverse position, normal control goes to the indication bus while reverse control gets battery. Following one of the control wires current is delivered to a pole changer switch controlling the armature connections of the motor, also the indication connections, back to the interlocking machine. The motor is of the series type and through the reversal of armature connections in the pole changer operates in one direction to set the switch points one way and in the opposite direction for the other position of the points. The pole changer is normally operated entirely mechanically by the last movement of the switch point locking device. It is, however, also under the control of two sets of magnets, so that should the points fail to complete their movement giving an indication, the position of the control lever may be shifted and, through the energizing of one of the sets of magnets, cause the pole changer to assume the position corresponding to that taken by the lever. It will be seen that this arrangement places the switch so under control of the leverman, that should the points be blocked with snow, sand or anything else, the operator may work the points back and forth to dislodge the obstruction, thereby permitting the desired movement of the switch to be completed.

The operation of the motor causes three separate and distinct movements occurring in the following order: Unlocks points raising detector bar at the same time, sets the points to the new position, and locks them there, at the same time lowering the bar, the last inch of travel of the locking plunger throwing the pole changer switch, disconnecting the live control wire and connecting the dead or indication wire to the still revolving motor whose armature connections are reversed. The current generated by the motor passes over the commons to the indication magnets of the lever, returning over the control wire to the other side of the motor. Kindly note here that the generated indication current flows in the same direction as bat-

tery current normally does, however, being generated at the opposite end of the conductors from that to which the battery is connected. It flows in a direction the reverse of what battery current would flow in an indication wire crossed with a control wire.

The opening of the control wire at the pole changer deenergizes the safety magnets located in the interlocking machine immediately below the indication magnets, allowing the indication current to pick up their common armature giving a complete indication. By this arrangement, in order to secure an indication of a switch having operated, the motor must revolve and several makes and breaks of circuits take place in a regular order. The most damage a failure of any of these actions can cause is a prevention of an indication requiring that the movement be made over again.

The function of the safety magnets is to prevent a false indication due to a connection between the two control wires allowing power current to flow back through the indication magnets. This is accomplished by making all current for either control wire pass in series through the magnets, in this way all current tending to cause an inducation must also act on the safety coils. As the common armature for the two sets of coils rests on the poles of the safety magnets and is a quarter of an inch from the poles of the indication coils an equal current in both sets of windings could cause no movement of the armature giving a false indication.

In the case of signals only one movement need be rigidly guarded by indication, as a signal might fail to show "proceed" without more damage than stopping a train; but one saying "proceed" when it should say "stop" might cause no end of trouble.

All standard signals are worked on a plan requiring power to make them move to and remain in the position indicating "proceed." In other words, they are so hung and counterweighted that if left to themselves they would always indicate "stop." In electric interlocking the motor is so connected to the signal that the counterweight action setting the signal to the horizontal position revolved the motor as a generator. The motor is not connected to the wires leading to the interlocking machine until almost the end of the movement, when current is allowed to pass through the indication magnets, insuring that the signal has assumed the desired position. At the same time the loading of the motor serves as a dash pot to bring the mechanism to rest without undue shock.

With solenoid dwarf signals a contact is closed between the indication wire and the return wire by the signal being returned to the "stop" position. This circuit is broken by the completion of the lever stroke cutting off all flow of current.

As shown before, all indication current flows in the same direction as operation current, but coming from an outside source it also flows in a direction opposite to that which operating power flowing out over a control wire and returning over an indication wire would take. This feature is taken advantage of to locate and make harmless any cross between wires. In order to accomplish this a polarized relay is wired into each indication circuit or placed in indication common. Normal indication current causes no movement of the armature, however, a cross will immediately cause curren' to flow in a reverse direction, opening the relay contacts, breaking the retaining circuit of the main circuit breaker. By pulling the fuse of the function in trouble, the cross may be temporarily removed until repairs can be made.

As was stated before a small current is necssary to hold a signal in the "proceed" position and unless provision is made for supplying this small current to the signal bus bar the opening of the circuit breaker might put the signal to 'stop" in the face of a train approaching on a route not affected by the cross. To prevent this the contacts of the circuit breaker are generally shunted by a resistance great enough to prevent passage of current sufficient for the clearing of another signal yet small enough to hold several signals in the "proceed" position.

As an additional check on the position of all facing point switches and derails it is customary to break either the control or return wire of a signal through a circuit controller attached directly to the rail points. At times advantage is taken of this feature to select by the position of a switch which arm of a two-armed signal shall be cleared. With one type of signals this is done by closing through the controller either one of two field windings on the signal motor, thereby securing a reversal of the direction of rotation.

The power required for operation is small, a switch motor requiring 6 amperes for only a little more than one second, and a signal but 2 amperes for about four seconds. A solenoid dwarf requires 5 amperes for only a fraction of a second. As an example, the aggregate of power required on a busy 52 lever plant passing some 500 trains per day will not amount to much more than 200 kw. hours per month. This including the lighting of some twenty signals for twelve hours each night with one candle power lamps. With a good gasoline engine plant from 2500 to 3000 lever movements may be secured for each gallon of fuel.

The apparatus described in the foregoing is that made by the General Railway Signal Company. The Union Switch & Signal Company has placed on the market three types of all electric plants. Their most recent type is similar in principle to the electropneumatic system, in that power is always maintained at each function, a pair of control wires serving to operate remote control switches for applying it to the motors.

There are in addition to the systems mentioned several other types on the market among which are those manufactured by the Hall Signal Company and the Federal Signal Company.

In small plants various methods are used in running the wires. Where the functions are stretched along one road for some distance, as in the case of sidings and crossovers at stations, it is not unusual to make use of a pole line. Where the movements are bunched, the wires are often carried in a wooden trough, or trunking as it is generally called. In this case frequently the wires are sealed in with asphaltum. At large and more important plants, some form of underground conduit is employed, manholes and handholes being used the same as in subway construction, in a city.

SOME FEATURES OF THE DESIGN AND CONSTRUCTION OF DYNAMO ELECTRIC MACHINES.[1]

BY CARL E. JOHNSON.

(concluded)

Alternating Current Machines—II.

Under the classification of alternating current machines we have the single phase of several different types and the polyphase motors of the constant, variable, and the multi-speed types.

For a majority of requirements there is no question but what the squirrel cage polyphase type, everything considered, is nearest to the ideal. This is by reason of its simplicity, lightness, low cost, high efficiency and general durability. In this motor we have two separate windings. One mounted on a stationary and the other on a rotating core and without commutator or the complicated parts of other types. The stationary or stator frame is always built up of steel laminations in the slots of which the windings are placed. The slots may be open or partially closed. In very few instances totally closed slots are used. Ordinarily small machines for the lower voltages are made with partially closed slots while the larger machines and machines for higher voltages have open slots for the reason that these allow the use of specially insulated coils. The closed slots, however, are preferable where it is possible to use them on account of the improved operating characteristics. The distinctive difference between the coils for a partially closed slot and open slot winding is that the latter are completely insulated and treated before being placed in the slots.

Basket or Diamond shaped coils are the most universally used. The assembly of the coils in the machine with the partially closed slots differs from the same operation in other types in that the coils are usually threaded through the openings into the slot one or two at a time. With this method the only insulation between the different turns of the same coil being the cotton covering on the individual wires. Basket type coils are mostly used with the one coil per slot winding. This means that each side completely fills one slot so that for instance in a 48 slot core only 24 complete coils will be required to make up a set. The ends of a coil iron to iron being taped after the coil has been put into the slot. The simple threaded diamond or two coil per slot type is wound either on a mould which finishes the coil to a proper shape or wound on pins or in a loop and pulled out similar to the direct current coils previously mentioned.

The span or throw of the coil here as in the armatures has a direct bearing on the performance of a given machine. A full pitch winding is one in which the span of the coil is equal to the number of slots in the core divided by the number of poles.

Fractional pitches are generally used on account of the considerable gain in end space and saving in copper. The effect of reduced span of the coil is the same as a reduction in the number of turns although the effect is not in direct proportion. From this it will be seen that this variation in span gives a very flexible means of obtaining different performances from a standard frame with a given number of turns per coil. For a given frame, number of slots, size of wire, turns per coil, and the connections of the groups remaining unchanged, a motor with a throw of 1 and 10 will have a greater available torque than one having a throw of 1 and 13. The increase in torque being obtained, however, at a sacrifice of power factor.

In alternating current motor stators, the groups are laid out according to winding diagram selected or necessary. The number of groups being equal to a product of the number of poles by the phase of the motor. The group may either be uniform, alternating, or irregular, according to the design of the motor. If the group is uniform all groups will consist of an equal number of coils. If the group is alternating every other group contains an equal number of slots and coils. If the grouping is irregular there is no apparent uniformity in the number of slots and coils per group but the total number of conductors per circuit per phase is usually the same. The groups are formed by connecting the required number of coils together, the end of the first coil to beginning of the second, etc., the beginning of the first coil and end of the last in the group forming the beginning and end of the group. Diagrams are made or drawn for the desired method of connecting the group. When it is desired to use one winding that may be connected for two or three standard voltages; the winding should be laid out if possible for equally satisfactory operation on either connection and that a minimum amount of labor will be required to change from one to the other. This laying out of connections for parallel circuits must be specially borne in mind, because it is evident any eccentricity of the rotor with respect to the stator will mean an unbalancing of the current in the different parallel circuits.

In connecting 3-phase stators in star the operation will be simplified if it will be remembered that in traveling from each of the three leads to the star points the direction of travel is reversed in adjacent groups.

Any star connection can be readily changed into a corresponding delta by opening the common junction and connecting the inner end of phase A to the outer end of phase B, and the inner end of phase B to the outer end of phase C, and the inner end of phase C to the outer end of phase A.

In laying out a given size frame for several different speeds and ratings it is sometimes necessary, in order to make the standard number of slots fit all these requirements, to use an irregular grouping.

Fig. 1 shows a standard 48 slot stator with a uniform grouping of 4 coils per pole per phase, which, as shown, is connected 2 circuit Y. In order to connect the same number of slots and coils 6 pole it is necessary to use an irregular grouping, which, as shown in Fig. 2, is also connected 2 circuit Y. The small figures under the arrows denote the number of coils in each group. By totaling these up it will be seen that the total number of coils per phase are the same. It is not possible to connect this winding as shown for 4 circuit or 110 volts but it can be readily changed to single circuit 440. The phase coils or coils separating the differ-

[1]Paper presented before Los Angeles Section, A. I. E. E., April 30, 1912.

ent groups are usually given an extra lapping of treated cloth over the outside ends. After connecting, the stator frame is usually given one of the many moisture and dirt repellant treatments,

The rotating part with its squirrel cage secondary winding as usually made is the simplest mechanically and at the same time is the most rugged and compact form of moving element to be found in any type of commercial electric motor. Its operating characteristics are dependent to a great extent upon its electrical resistance, a rotor with a low resistance will have good efficiency and small slip and will have less starting torque for a given current; on the other hand

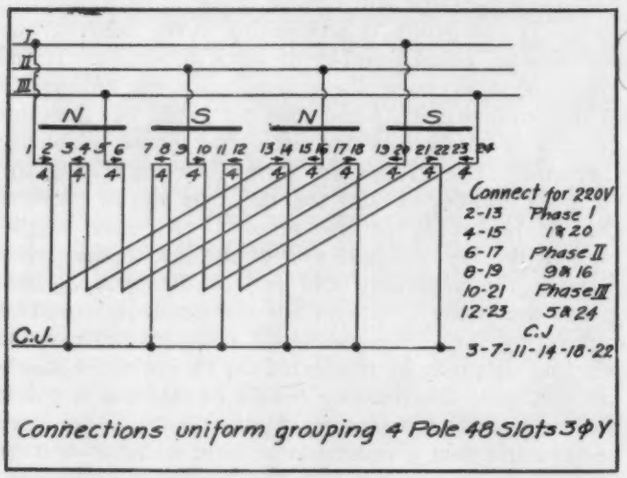


Fig. 1.

a rotor of high resistance will have low running efficiency and a large slip and will give a high starting torque with a minimum current. These characteristics make the high resistance rotor adaptable to some classes of machine, crane, and elevator work where starting under heavy load is frequent and operation required for short intervals only. The high resistance rotor exerts its maximum torque at starting and the torque decreases as the speed increases. With their load they accelerate slowly developing approximate double full load torque with about two and a half times normal current although full voltage is at once impressed on the stator. There is a marked contrast to this performance when it is considered that with the standard low resistance rotor, all other conditions being equal, to develop only full load torque at the start requires about four times normal current. In their favor also is the elimination of the expensive controller and resistance, brushes, brush-holders and collector rings, all necessary with the phase wound rotor. It has been found by experience that the best results are secured with a slip as high as 20 per cent and to date, to my knowledge, these motors have not been developed in sizes much above 15 h.p. owing to the starting current.

There are many styles and methods of construction of both different types employing bars of many shapes. The rotor bars are usually cut from soft drawn bar stock and inserted in the rotor slots which, with some exceptions, are as a rule always partially closed.

There is very little choice between bare and insulated rotor conductors in the smaller sizes.

On large rotors where voltage is appreciable from one end of the bar to the other, local currents are set up in the punchings where bare bars are used which will reduce the starting torque but will have very little effect under full load running conditions. In such case it is advisable to insulate the bars.

The end rings are made of copper, brass, or various grades of resistance alloys. The resistance of the rings and consequently the characteristics of the motor depend upon both the width and thickness of the ring as well as its composition and may be varied over a wide range by changing these dimensions.

Solder is sometimes used for fastening the rotor bars to the end rings but too much stress cannot be

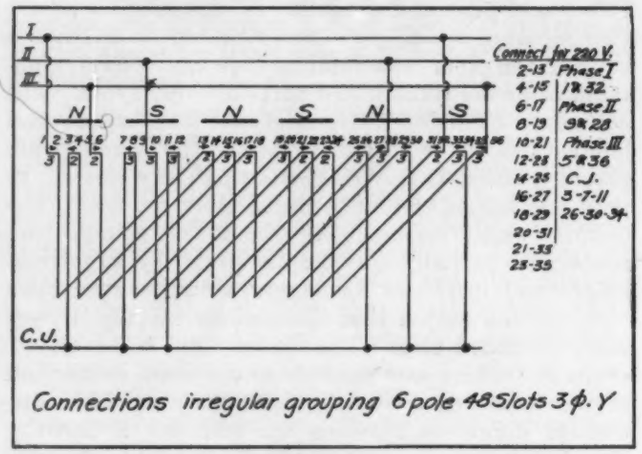


Fig. 2.

laid on having, first of all, as perfect a mechanical joint as possible. Under severe conditions of service, solder will, very often, melt, and unless there is a perfect mechanical joint to rely on, the result will be a serious loss of speed, necessitating repairs. If solder is depended upon at all it should always be hard and of high melting point.

Some forms of fans are usually provided to promote ventilation and aid in the dissipation of the heat. Rotors of the constant speed type are sometimes wound with short circuit diamond shaped coils and instead of being connected together each coil forms an independent closed circuit or loop. This arrangement allows of thorough ventilation and will develop a good starting torque.

The stators of the variable speed poly-phase motors are practically identical with those of the constant speed type. The rotors are phase-wound usually with diamond shaped or open end coils of either wire or strap inserted in partially closed slots. The coils of each group are connected in series and the groups of each phase are ordinarily connected in series, the phases being connected, usually in star.

These motors are generally used where it is necessary to start a heavy load with small starting current and operating for long intervals of time with good efficiency or wherever it is necessary to vary the speed from time to time. Their operating characteristics are similar to those of a shunt wound direct current motor, where speed variation is obtained by inserting resistance in the armature circuit. Three-phase wound rotors are generally used with either two or three-phase wound stators for the reason nothing is gained

in the use of two-phase rotors and they usually require an extra ring. In some few cases phase wound rotors have been equipped with only two rings, the other open end being grounded. This simplifies construction, somewhat lessens cost, but is unsatisfactory in as much as the bearings are called upon to carry a portion of the rotor current.

Some classes of service and conditions call for a polyphase motor which will give different speeds and maintain each speed irrespective of what portion of its full rated load it has to carry. To meet these conditions there has been suggested and developed a number of different schemes. Of these different types

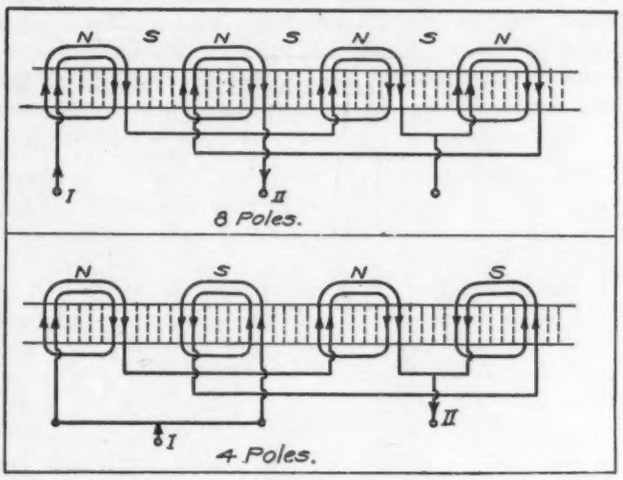


Fig. 3.

let us dwell upon, brieffy, the most extensively used or what is commercially known as the multi-speed motor.

The stator structure and rotor of this motor is similar also to the standard polyphase motors. In this type of motor the different synchronous speeds are obtained by changing the connections and re-grouping the coils of any one or two stator windings and thereby changing the number of poles. Fig. 3 shows a simplified diagram of one phase of a multispeed motor as connected for 4 and for 8 poles. The standard type of squirrel cage rotor is in most cases used, although in this type of motor it is also possible to use the phase wound rotor. By a combination of multi-speel stator and the phase wound rotor it is possible to obtain speed variation of a very wide range at good efficiency but the motor and control apparatus become so greatly complicated that the saving in power is not warranted. There are a number of different methods that may be used in connecting the windings of such motors, the selection of connections in any case depending upon the relative maximum outputs required at the different speeds. In the two speed motor with single winding the connections which will work the material to best advantage is the one in which the groups are connected in two circuit star for a 100 per cent maximum output and speed, and connected in single circuit delta for 50 per cent speed. The 50 per cent speed connection will carry approximately 65 per cent of maximum output.

Reference to Fig. 4 will show one method of connection by which it is possible to secure two speeds. By combining two such windings on one stator, one for four and eight poles and the other for six and twelve poles it is possible to procure four distinct speeds. A four speed motor of this kind would have fourteen leads to connect to. The connections for the different speeds being accomplished with the aid of a small drum.

In this type of motor approximately one-half of the total amount of copper is inactive and the delta circuit which is not in use must be opened at one corner to eliminate complications through induced currents.

In these motors the efficiency is approximately the same at each speed and the power factor, which

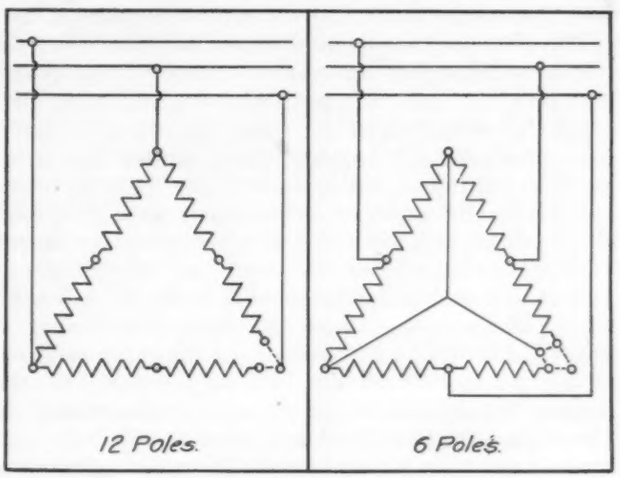


Fig 4.

is lower at full speed than the normal motor, is reduced very greatly at the lower speed. The percentage of slip remains approximately the same for each speed and the starting torque per ampere varies approximately inversely as the speed.

Under the heading of single phase we have the split phase, resistance reactance, and several types of the repulsion. The split phase induction motor is quite generally used, especially in small sizes, because its construction and winding is simple and inexpensive. It is inherently a constant speed motor and cannot be made to vary. The stator is provided with a main winding and a starting nearly always in partially closed slots. The main winding consists of many turns of relatively heavy wire, cosequently its inductance is high compared with its resistance and its power factor at the start is correspondingly low. The starting winding is comparatively light and of high resistance. The resistance is therefore the predominant characteristic of this winding. The power factor is correspondingly high and the currents in the two windings are out of phase by a considerable angle thereby producing a rotating field sufficient to start the rotor.

The relative use of turns of the main and starting winding depends on the design. If the machine is designed for a high starting torque, the wire in the starting winding will be large and will have a lesser number of turns. The electrical characteristics and the size of wire in the starting windings may thus vary greatly in two machines of the same rated horsepower and speed.

The stator poles are wound with pyramidal coils, the wire being threaded into the slots from spool or spools or they may be wound by the less expensive skein method.

An automatic centrifugal switch serves to open the starting winding after approximately one-half speed has been attained.

Rotors of the squirrel cage type are used, although in some of the larger sizes, to insure good starting torque with minimum current, combinations of the squirrel cage and phase winding are extensively used.

With the split phase type of motor, clutch pulleys are generally used on account of the inherently poor starting torque as compared with other types.

The resistance reactance type of motor is virtually a three-phase squirrel cage induction motor in which an imperfect three-phase rotating field is produced by the use of a non-inductive resistance and reactance connected in the stator circuit while starting. The starting torque of these motors also is inherently limited.

For many power requirements on single phase circuit which demand a specially good starting torque with minimum current we have one form of repulsion motor, due to Latour, which possesses a combination of series and shunt characteristics; namely, a limited speed with increase of torque with decrease of speed. To secure the necessary torque in the straight repulsion motor, a direct current armature is placed in a magnetic field and short circuited through brushes set with a predetermined angular relation to the stator field. To further improve the operating characteristics of the plain repulsion motor a second set of brushes, viz. the compensating brushes, is placed at 90 electrical degrees from the main short circuiting or energy brushes. These compensating brushes are connected to a winding in the main field of the motor, this winding may be either the center section of the main winding as in a compensator or separate coils wound concentric with the main field. The purpose of the compensating winding are, first, to secure a reasonably constant speed independent of the load and, second, to obtain high power factors. In these motors the power factor is very good under all conditions and the greater portion of the exciting current is supplied from the compensating circuits, thus relieving the main winding from the necessity of furnishing this current. When used on variable speed works a variable resistance is inserted in the energy circuit.

Of the several other more or less modified forms of repulsion motors that should be mentioned before closing is the one due to Mr. Val Fynn of England, the main structural departure in this motor is that two windings are employed on the rotor. The main or principal winding is the usual well known squirrel cage type and occupies the bottom of the slots. The second or auxiliary winding is of the usual commuted type, is connected to the commutator and occupies the top of the slots. Between the two is placed a magnetic separation in the form of a steel bar. The brushes and windings on the frame are similar to the ones on the motor last mentioned but the connections are slightly different. Its action is as follows: At starting the commuted winding is connected in series with the main stator winding and across the mains. A small automatic centrifugal switch provided serves to connect the compensating winding to the brushes after sufficient speed has been reached. This automatic switch is not essential to the operation of the motor but does serve the purposes by cutting in the compensating winding to improve the power factor and slightly improve the efficiency in the running condition.

This motor as commercially manufactured has a leading power factor at light loads and a substantially unity power factor from half load to 50 per cent overload. It is also adaptable to variable speed and has been in practical commercial use for sometime in a few of the European countries, although not extensively as yet in this country.

COMPLAINTS.

BY GEORGE DICHLMAN.[1]

It must be apparent to all executives of public service institutions that they can hope for a square deal from the voter only when they deserve it. When convinced that the corporations, in their dealings with him, are sincerely endeavoring to serve and please as do the grocer and other merchants, the voter will be less eager to allow the political agitator to influence him. He will more readily appreciate the fact that his interests are identical with those of the corporations and will select public officials from the ranks of business men, wide in commercial experience, broad in their views, possessing true public spirit and fair in their official acts when regulating the conduct of the utility corporations.

It has been demonstrated in several instances in public utility history, that the average citizen is fair-minded. Upon receiving the treatment expected from corporations, he in turn will show his appreciation by upholding them in their contentions. Is it not possible that much of the adverse legislation in recent years is due to unconscious neglect upon the part of public utility executives when dealing with their customers; by not giving more personal attention to the handling of their grievances? These seemingly unimportant details, when not placed in competent hands, are mismanaged, and become, in the aggregate, weighty factors in creating an unfriendly attitude toward public service corporations.

Serving, as they do, the majority of the people, it might behoove gas managers to do their duty toward helping the citizen tide over this stage of more or less blindly radical legislation, by giving more personal attention to his grievances. When the professional politician denounces corporations, among those contributing the heartiest applause is the same citizen who has a kick against the gas company. The housekeeper with a high bill, who has been granted the use of the ballot in several of the states, will not be slow in venting her ire upon the heads of corporations in general for taking such a slice out of her household allowance—the grievance of the male voter is of no greater importance.

We know that the gas company employe, coming in contact with these voting customers, is unconscious-

[1] New Business Department, Western States Gas and Electric Company, Stockton, Cal.

ly instrumental in molding public opinion. Upon his conduct, depends to a large extent, the good or ill-will of the public towards the company. By overlooking the least opportunity to please the customer, he can, in a measure, undo the plans of the executive in his work of forming a good service organization.

Of all departments coming in contact with the public, the one handling the complaints of high bills seems the most important. The essential thing to be desired, is to attend these complaints in such a manner as to leave the customer with no ill feeling toward the company. The men at the windows receiving the cash, and those adjusting the complaints can do a great deal to accomplish this essential good feeling. It is these men, together with the employes doing the outside work, who are the "gas company," according to the great majority of the customers; even more than the manager, whose executive duties allow him to meet only a small minority of the consumers.

In attending to complaints of high bills, are gas companies generally as progressive as they might be? Considering the fact that the good will of the people largely depends on the proper treatment of their grievances, imaginary or otherwise, is it not desirable to give them every attention? Among these, the complaint of a high bill perhaps ranks first, as this amounts to a matter of dollars and cents to the customers. Most gas men realize the amount of ill will created by one of these complaints if not properly taken care of.

The more up-to-date managers have adopted a plan of isolating the complaint department, placing it in charge of a competent man, who endeavors by close questioning, comparison with previous bills, testing and explaining operation of meters, to convince the customer that the gas bill is correct. Some managers increase the efficiency of the department by sending demonstrators to call at the home and show the customers how to economize. This accomplishes better results.

While, in this manner, a good percentage of complaints are taken care of, those who have watched this department have noticed that many complaining customers leave the office apparently calmed, but who feel that in some way the hands on the dials of the meters might have indulged in a race with one another. These customers pay their bills under a silent protest, the department has failed to accomplish its purpose.

In many cases, the office man, reaching the end of his resources in reasoning with the customer, offers to test the meter. Although meters should be tested regularly, regardless of complaints, can we not question the advisability of testing because of the high bill before we have made further investigation? Upon close observation, we are lead to believe that this action is not effective. The customer is apt to think that the company is in doubt as to the accuracy of the meter. Even when shown that it tested O. K. some feel that they were hoodwinked in some way.

Another objection to this method is, that in spite of the isolation of the investigation department, if more than one complaining customer is in there at the same time, as is so often the case during the rush, those waiting their turn are sure to talk over their troubles with each other, and thereby each gains the impression that complaints are general. "Everybody is kicking." Again, if kept waiting any length of time, they are in no fit frame of mind to be dealt with, thus making it more difficult to reason with them.

Again, the office man cannot convince a large proportion of the complaints that the big bill is really their own fault. Not being at the seat of the trouble, and therefore not conversant with the local conditions, he is more or less at a disadvantage.

In view of the above facts, it seems reasonable to believe that we should arrange to get them out of the office, away from the rest of the customers.

Regarding the plan of sending a demonstrator to the home, let us again question: Is it a good policy to send a lady demonstrator out on these complaints? Valuable as we all know the demonstrator to be in her other lines of work, we are inclined to believe that, for several reasons a man can accomplish better results. For this particular work, it is essential that a competent person should be secured. Not an inexperienced clerk or the average stove man, but one, who, besides having considerable experience handling customers, is thoroughly familiar with the operation of gas appliances, and has a fair knowledge of how they should be operated economically. It is preferable that he be mature in years, that he may command respect.

After a recent experience, I am inclined to believe that we can bring about more effective results by adopting another plan. In one of the Byllesby properties, recently acquired, we worked with the office complaint man, and tried the experiment of taking the customer aside, and in a kindly manner stated that we were sorry to hear his bill was high, and that we would give him or her our immediate attention, and would call at the house to see what was wrong. Almost without exception, and without attracting the attention of other customers the complaint was thus temporarily disposed of in a peaceable manner. Most customers seem to prefer this plan, because they leave the office with the intention of telling their trouble when they get a representative of the gas company in their home.

We would call at the house as soon as possible, preferably in the forenoon, stating that the manager personally sent us to find out the trouble. We found the customer in a more receptive frame of mind—she was in her own home instead of in the gas office. This time of day nearly every housekeeper was using some part of her range. In many cases, she was caught redhanded wasting gas in some manner easily detected. This gave us considerable advantage. By asking questions in a kindly way, we would generally find that they were wasting gas either at the range or water heater. After showing how important small economies were in the aggregate, we came to the most important part of the procedure, viz: Teaching the customer to read her own meter. The talk went something like this: "Mrs. Smith, I believe that, if you will help me, we can materially cut down the big bill. First, if you will come to the meter with me, I'll show you how to read it, so that you need not depend on our man. You can figure out your own gas bill. It's so easy a ten-year-old child can do it. You check up your other household bills each month, why not your gas bill?"

The housekeeper did not resent this sort of talk.

That enormous gas bill was fresh in her mind. The fact that we called, and thereby showed a personal interest, in her, convinced her that we were sincere in our efforts, and that it might be to our interest to go to this bother. She was taught to read the meter, and then taken back to her kitchen and something like this followed: "Now, Mrs. Smith, while I am here, I'll ask you to make a note of the date and statement of your meter, as you and I read it today, and I am going to adjust your appliances (or send a man tomorrow) and will you work with us to the extent of practicing the small economies I have suggested to you, for one week, and to be sure to again read your meter a week from today, and figure out how much gas you used during that time? Read it again two weeks from now, and compare the two amounts. See if you have been able to make the second week bills smaller than the first. If you should get confused in your figures, call me up, here's my card, and I'll set you right. If the two different weeks vary much, being only a few days back, it is fresh in your memory, and you can think back, and see where you have made a saving or where you used a little more gas than the week before."

Upon leaving, nearly every customer thanked me for calling and promised to watch the range and the meter. I have closely observed the results of this method, and find it to be most successful in making a friend for the company, and permanently disposing of the complaint. Handled in this manner, a very small proportion of the customers ask to have their meters tested.

Is this a more expensive way of accomplishing results? Granting the extra cost of handling complaints in this manner, over the plan of promiscuous testing of meters, is not this expense justifiable, when we consider that we have obtained far more satisfactory results?

It has been my observation that complaints handled in this way are appreciated by the customer. It converts a "knocker" into a "boosting" housekeeper, a gas company's most valuable asset.

TROUBLE DATA REPORTS IN SAN DIEGO.

The investigation department of the San Diego Consolidated Gas and Electric Company is alive to collecting every available piece of information which may lead to a reduction of complaints. An automobile is kept ready at any instant to speed away for the relief of some customer should complaint in the service arise at any time. Below is a copy of the interesting leaflet which is filed away upon the return of the investigator in the case of a call to examine a consumer's service.

A careful glance at the data called for on this investigation order gives a comprehensive idea of the minute compilation of details undertaken by this utility company in diminishing the number of complaints. At stated intervals the different answers are tabulated and by this means the one having this work in charge can far more accurately judge from which source the complaints arise and often thus handle a whole series of complaints by reducing to a minimum a common defect causing the complaints to arise.

Form 117—9-11—6M—P. & S.

B San Diego Consolidated Gas & Electric Company

GAS

No 22763 INVESTIGATION ORDER

Date .....191.....

Name .....

Address .....

Meter Number .....

Test Meter .....

Re-read Meter .....

No Gas .....

Poor Pressure .....

Place Rec. Pres. Gauge .....

Adjust Range ..... *W. H.* ..... *Lights* .....

Trace Piping .....

Misc. .....

.....

This investigation is being made at {VERBAL / WRITTEN / PHONE} *request*

of .....191.....

Investigate promptly and report fully in blank spaces hereon, to the undersigned.

By .....

REPORT

Meter Number .....

Index .....

Remarks .....

.....

.....

Received .....A. M. .....P. M. *Arrived* .....A. M. .....P. M. *Departed* .....A. M. .....P. M.

Date Completed .....191.....

By ..... *Meterman*

REPORT

Is the pressure O. K.? .....

Is piping gas-tight? .....

Are meter connections O. K.? .....

Location of leak, if any? .....

.....

Rate of leak? .....

No. of gas jets used? .....

What kind of burners? .....

Condition of burners? .....

.....

Has consumer a gas range? .....

What kind? .....

Condition? .....

Has consumer a hot plate? .....

What kind? .....

Condition? .....

Has consumer a gas water heater? .....

What kind? .....

Condition? .....

Has consumer a gas heating stove? .....

What kind? .....

Condition? .....

Other appliances in use? .....

.....

Is there any unnecessary waste of gas; if so, where? .....

.....

.....

.....

.....

What can you suggest to better the service and avoid the waste of gas? .....

WESTERN LAWS OF ELECTRICITY AND WATER

WATER RIGHTS ON INTERSTATE STREAMS.

BY A. E. CHANDLER.

The principles of either the doctrine of riparian rights or of that of prior appropriation have been thus far considered as developed within the various western states and no mention has been made of the right to use the waters of interstate streams. A little consideration only is necessary to recall to one the great number of rivers which either flow from state to state or form the boundary line between them. The Snake from its headwaters in the mountain lakes of Wyoming meanders across Idaho, crosses and re-crosses the Idaho-Oregon boundary line, flows through southeastern Washington and finally joins the Columbia, which is the boundary between Washington and Oregon. The tributaries of the Missouri rise in Wyoming and the main stream flows through or touches Montana, North Dakota, South Dakota, Nebraska and Kansas. The principal tributaries of the Colorado, the Green and the Grand, rise in Wyoming and after their confluence in Utah the main river flows into Arizona and becomes the boundary between Nevada and Arizona, and also between California and Arizona. The Rio Grande rises in Colorado and flows through New Mexico into Texas.

The waters of all of the great rivers mentioned are used to some extent in irrigation but with the exception of the Rio Grande, and possibly the lower Colorado, there is no likelihood of trouble in the near future between states regarding their use. The interstate streams which have been in controversy are the small mountain tributaries whose small flow was early appropriated. On such streams it is very common to find ditches heading in the upper state and irrigating lands in both the upper and lower states. Willey v. Decker (73 Pac. 210) dealt with Young's Creek flowing from Montana into Wyoming and back again into Montana, and the Supreme Court of Wyoming therein held (as reported in a head note):

> In the absence of statutory provisions, owners of land in Montana may acquire a legal right by prior appropriation to the use of the waters of a stream having its source in that state, and flowing thence * * * in Wyoming, by joining with owners of land in Wyoming in the construction of a ditch, and thereby diverting the waters of the stream at a point within Wyoming for the irrigation of lands in Montana and Wyoming.

Sage Creek is another small stream rising in Montana and flowing into Wyoming. In Howell v. Johnson (89 Fed. 556) the defendants contended that the plaintiff, having a water right under the laws of Wyoming, could not have a federal court enforce the same, and also that the rights to water were under the control of the legislature of Montana. The court, however, applied the doctrine of appropriation regardless of state lines and held for the plaintiff—diverting in the lower state, Wyoming. The lower prior diversion was likewise protected in Hoge v. Eaton (135 Fed. 411) wherein appropriators from Sand Creek in Wyoming complained of a later diversion of the creek in Colorado. The court therein said:

> The right to divert running waters for irrigating lands in an arid country is not controlled or affected by political divisions. It is the same in all states through which the streams so diverted may pass.

The waters of Sage Creek were again in controversy in Bean v. Morris which was decided by the United States Supreme Court May 29, 1911 (221 U. S. 485). The Supreme Court therein said:

> But with regard to such rights as came into question in the older states, we believe that it always was assumed, in the absence of legislation to the contrary, that the states were willing to ignore boundaries, and allowed the same rights to be acquired from outside the state that could be acquired from within. * * * * * There is even stronger reason for the same assumption here. Montana cannot be presumed to be intent on suicide, and there are as many if not more cases in which it would lose as there are in which it would gain, if it invoked a trial of strength with its neighbors. In this very instance, as has been said, the Big Horn, after it has received the waters of Sage Creek, flows back into that state. But this is the least consideration. The doctrine of appropriation has prevailed in these regions probably from the first moment that they knew of any law, and has continued since they became territory of the United States. It was recognized by the statutes of the United States, while Montana and Wyoming were such territory, * * * and is recognized by both states now. Before the state lines were drawn, of course, the principle prevailed between the lands that were destined to be thus artificially divided. Indeed, Morris had made his appropriation before either state was admitted to the Union. The only reasonable presumption is that the states, upon their incorporation, continued the system that had prevailed thereofore, and made no changes other than those necessarily implied or expressed.

The cases thus far referred to did not raise the doctrine of riparian rights, although it is thought to still exist in Montana. The conflict of doctrines was before the Federal Circuit Court in Anderson v. Bassman (114 Fed. 14) wherein the plaintiffs were farmers using the waters of the West Carson River in Nevada and the defendants were irrigators from the same stream in California. In the decision Judge Morrow points out that the doctrine of appropriation is alone recognized in Nevada while California uses the dual system of appropriation and riparian rights. On account of the conflict of accepted systems no attempt was made to ascertain individual rights of priority but the case was decided by allowing the farmers in California the use of the entire stream for five days out of ten and a like use to those in Nevada.

Kansas v. Colorado.

By far the most important case dealing with the use of the waters of an interstate stream is Kansas v. Colorado (206 U. S. 91) decided by the United States Supreme Court May 13, 1907. It was initiated on May 20, 1901, by Kansas charging Colorado with the wrongful diversion of the waters of the Arkansas River. On May 21, 1904, the United States intervened in behalf of its operations under the Reclamation Act of June 17, 1902.

Kansas claimed that the waters of the Arkansas should be allowed to flow as they were accustomed to flow, and that by the diversions in Colorado not only

were the property owners along the river deprived of its surface flow but all land owners within the drainage area were deprived of the beneficial influence of the subterranean flow.

Colorado contended that under the provisions of its constitution it is the owner of all waters within its borders. It further contended that the Arkansas River is substantially two rivers—the Colorado Arkansas rising in the Rocky Mountains and sinking, in times of low water, in the sands of Western Kansas, and the Kansas Arkansas which is formed by springs and surface drainage in Western Kansas east of the sink of the Colorado Arkansas.

The United States in its petition in intervention sets forth the vast acreage of public lands to be reclaimed under the provisions of the Reclamation Act, the reliance of the arid west upon the doctrine of prior appropriation, the inapplicability of the riparian doctrine where irrigation is necessary, the contention of Kansas that it is entitled to have the waters of the Arkansas flow uninterrupted and unimpeded into Kansas, the contention of Colorado that it is the owner of all waters within the State, and closes with the following:

> That neither the contention of the State of Colorado nor the contention of the State of Kansas is correct; nor does either contention accord with the doctrine prevailing in the arid region in respect to the waters of natural streams and of flood and other waters. That either contention, if sustained, would defeat the object, intent, and purpose of the reclamation act, prevent the settlement and sale of the arid lands belonging to the United States, and especially those within the watershed of the Arkansas River west of the ninety-ninth degree west longitude, and would otherwise work great damage to the interests of the United.

Justice Brewer, who wrote the opinion, after showing that the case is one over which the Supreme Court has jurisdiction said:

> Turning now to the controversy as here presented, it is whether Kansas has a right to the continuous flow of the waters of the Arkansas River, as that flow existed before any human interference therewith, or Colorado the right to appropriate the waters of that stream so as to prevent that continuous flow, or that the amount of the flow is subject to the superior authority and supervisory control of the United States. * * * * * Is the question one solely between the states or is the matter subject to national legislative regulation, and, if the latter, to what extent has that regulation been carried? * * * * The primary question is, of course, of national control.

The power of congress to preserve the navigability of streams is first examined with the conclusion:

> It follows from this that if in the present case the national government was asserting, as against either Kansas or Colorado, that the appropriation for the purposes of irrigation of the waters of the Arkansas was affecting the navigability of the stream, it would become our duty to determine the truth of the charge. But the government makes no such contention. On the contrary, it distinctly asserts that the Arkansas River is not now and never was practically navigable beyond Fort Gibson in the Indian Territory, and nowhere claims that any appropriation of the waters by Kansas or Colorado affects its navigability.

The court then proceeds to examine "the question whether the reclamation of arid lands is one of the powers granted to the general government," pays particular attention to that part of section three of article four of the constitution reading: "The congress shall have power to dispose of and make all needful rules and regulations respecting the territory or other property belonging to the United States * * *," and concludes that the section grants to congress no legislative control over the states, but gives it authority over federal property within their limits. It is stated that the constitution is silent regarding the reclamation of arid lands as no such problem existed at the time of its adoption, that with the extension of national territory large areas of arid lands have been included, and that "it may well be that no power is adequate for their reclamation other than that of the national government. But if no such power has been granted, none can be exercised."

It is the last sentence quoted which has led many to believe that the Supreme Court in this case declared the Reclamation Act unconstitutional. The validity of that Act, however, was not in issue, but the question of national control—that is, the superior right of congress to legislate regarding the reclamation of arid lands—was. This should be clear from the following quotation which is from the paragraph immediately following the sentence referred to:

> It does not follow from this that the national government is entirely powerless in respect to this matter. These arid lands are largely within the territories, and over them by virtue of the second paragraph of section three of article four heretofore quoted, or by virtue of the power vested in the national government to acquire territory by treaties, congress has full power of legislation, subject to no restrictions other than those expressly named in the constitution, and, therefore, it may legislate in respect to all arid lands within their limits. As to those lands within the limits of the states, at least of the western states, the national government is the most considerable owner and has power to dispose of and make all needful rules and regulations respecting its property. We do not mean that its legislation can override state laws in respect to the general subject of reclamation. While arid lands are to be found, mainly if not only in the western and newer states, yet the powers of the national government within the limits of those states are the same (no greater and no less) than those within the limits of the original thirteen, and it would be strange if, in the absence of a definite grant of power, the national government could enter the territory of the states along the Atlantic and legislate in respect to improving by irrigation or otherwise the lands within their borders. Nor do we understand that hitherto congress has acted in disregard to this limitation.

After quoting from Gutierres v, Albuquerque Land Company (188 U. S. 545) the court continues:

> But it is useless to pursue the inquiry further in this direction. It is enough for the purposes of this case that each state has full jurisdiction over the lands within its borders, including the beds of streams and other waters. * * * * It may determine for itself whether the common law rule in respect to riparian rights or that doctrine which obtains in the arid regions of the West of the appropriation of waters for the purposes of irrigation shall control. *Congress cannot enforce either rule upon any state.*

It is certain from the above that the state and not the nation is superior regarding legislation concerning the use of public waters not navigable. As stated, the Supreme Court believed it to be the "primary question" involved in the case and, after such careful and direct consideration, the decision must be accepted as final.

Coming to the direct issue between the two states, it is held that the dispute must be so adjusted "upon the basis of equality of rights as to secure as far as possible to Colorado the benefits of irrigation without

depriving Kansas of the like beneficial effects of a flowing stream." Tables are set forth in the opinion showing the increase in population, acreage irrigated, and value of farm products in the counties of eastern Colorado traversed by the Arkansas River. The court comments on the marked development thus evidenced and says that, as shown by the testimony, it is undoubtedly due to irrigation. A like examination is made of the census statistics for the counties of western Kansas with the conclusion that the use of the water in Colorado has not been of serious detriment to such counties.

The substance of the decision is well presented in the following paragraphs:

Summing up our conclusions, we are of the opinion that the contention of Colorado of two streams cannot be sustained; that the appropriation of the waters of the Arkansas by Colorado, for purposes of irrigation, has diminished the flow of water into the State of Kansas; that the result of that appropriation has been the reclamation of large areas in Colorado, transforming thousands of acres into fertile fields and rendering possible their occupation and cultivation when otherwise they would have continued barren and unoccupied; that while the influence of such diminution has been of perceptible injury to portions of the Arkansas Valley in Kansas, particularly those portions closest to the Colorado line, yet to the great body of the valley it has worked little, if any, detriment, and regarding the interests of both states and the right of each to receive benefit through irrigation and in any other manner from the waters of this stream, we are not satisfied that Kansas has made out a case entitling it to a decree. At the same time it is obvious that if the depletion of the waters of the river by Colorado continues to increase there will come a time when Kansas may justly say that there is no longer an equitable division of benefits and may rightfully call for relief against the action of Colorado, its corporations and citizens in appropriating the waters of the Arkansas for irrigation purposes.

The decree which, therefore, will be entered will be one dismissing the petition of the intervenor, without prejudice to the rights of the United States to take such action as it shall deem necessary to preserve or improve the navigability of the Arkansas River. The decree will also dismiss the bill of the State of Kansas as against all the defendants, without prejudice to the right of the plaintiff to institute new proceedings whenever it shall appear that through a material increase in the depletion of the waters of the Arkansas by Colorado, its corporations or citizens, the substantial interests of Kansas are being injured to the extent of the destroying the equitable apportionment of benefits between the two states resulting from the flow of the river.

It must be emphasized that the Supreme Court in its decree did not attempt to make an equal division of the waters of the stream, but rather an equitable apportionment of benefits. Neither the rule of prior appropriation nor that of riparian ownership is followed, but the case is allowed to rest on the "cardinal rule of equality of right"—not to the means but to the results.

Legislation Regarding Interstate Streams.

In 1911 California enacted legislation making it unlawful to transport the waters of any lake or stream of the state "into any other state, for use therein." Colorado in the same year authorized a joint legislative committee to investigate the interference by the federal government or any state, corporation or individual with the control by Colorado of the waters within its borders. Wyoming, likewise in 1911, authorized its attorney general, under the direction of the governor, to bring such actions "as he may deem expedient to maintain the rights of the state and its citizens in the waters of interstate streams."

The only state which provides by statute for the recognition of diversions from interstate streams is Oregon. By the Act of February 23, 1911, it is provided that no permit for the appropriation of water shall be denied because the point of diversion, or any portion of the works, or the place of intended use, or any lands to be irrigated may be situated in some other state; "provided, however, that the state engineer may in his discretion, decline to issue a permit where the point of diversion described in the application is within the State of Oregon but the place of beneficial use in some other state, unless under the laws of such state water may be lawfully diverted within such state for beneficial use in the State of Oregon."

Legislation similar to that of Oregon should be enacted by all the states where rights are initiated by an application to the state engineer. Cases are constantly arising where applications are made for proposed systems lying partly within two states. Without definite legislation the state engineer has no guide to action—some engineers have approved such applications, others have rejected them. In New Mexico the territorial engineer approved an application for the irrigation of lands in New Mexico by a ditch heading in the Animas River in Colorado about six miles above the interstate line. The matter reached the courts and the Supreme Court of New Mexico decided that "the territorial engineer was without authority to approve the application in question." (Turley v. Furman, 114 Pac. 278, decided March 4, 1911).

Not only is legislation necessary in regard to the initiation of rights for interstate ditches in order to protect the one so appropriating water, but it is badly needed in the interest of the general public in dividing the public waters among ditches entitled thereto. At present the only means provided by statute for distributing the waters of streams is the authority given the water commissioners, or water masters, to close, or partly close, headgates so that the later and upper ditches cannot take the waters belonging to prior appropriators. As such officers cannot act beyond the borders of their state they are powerless to control a ditch heading above their state line. The state engineer of Nebraska reports that one ditch diverting water from the North Platte in Nebraska near the state line was extended so that it headed in Wyoming about two hundred feet above the state line. It thereupon proceeded to take all the water desired while the ditches heading below in Nebraska and having earlier rights had their supply regulated, and in some cases entirely cut off, by the state officials in charge.

To remedy this condition the state engineer of Nebraska has recommended "that every canal flowing into this state have a controlling gate and measuring flume just within the state and in addition thereto a return canal whereby the water sought to be appropriated may flow back to the stream from which diverted." Other state engineers have made similar

suggestions. In many cases the construction of a "return canal" would necessitate heavy expenditures and appear prohibitive, but the situation on many streams is sufficiently serious to warrant drastic action.

The 1911 California legislation referred to above is copied from a statute adopted in New Jersey in 1905. The constitutionality of the latter was upheld by the United States Supreme Court in Hudson Water Company v. McCarthy (209 U. S. 349). It is specifically stated in the opinion therein, however, that "The problems of irrigation have no place here * * *," so the decision will not necessarily control in attacks upon the validity of such statutes in the western states. In further support of their validity it is important to note that most of the earlier decisions regarding rights on interstate streams lay down the rule of prior appropriation regardless of state lines in the absence of statutory provisions to the contrary. The argument against such prohibitive legislation must be based on reasons of policy rather than those of law. As suggested in the quotation from Bean v. Morris above, each state stands to lose just as much as it can gain by such statutes.

Summary.—From a consideration of the cases dealing with interstate streams (the leading ones only being mentioned above) the following conclusions are justified. The state and not the nation is superior regarding legislation concerning the use of public waters, excepting only the matter of navigation wherein the nation controls. Between private appropriators in two states recognizing only the doctrine of prior appropriation it is very probable that that doctrine will be applied regardless of state lines. Between private appropriators in two states, one or both of which recognize the doctrine of riparian rights, the priority of appropriations will not be established, but the waters will be distributed on an attempted equitable basis suggested by the particular facts of the case. In a controversy between two states in their soverign capacities the principle established in Kansas v. Colorado will undoubtedly be applied, and the Supreme Court will decide in accordance with what the facts of the case indicate to be an equitable apportionment of benefits. Legislation forbidding the diversion of waters from within a state to another state is probably legally sound but is based upon such shortsighted policy that it cannot prevail.

PINK SPECIAL TRAIN de LUXE.

The above is a picture of the "Pink Special" train de Luxe enroute to the N. E. L. A. convention at Seattle over the Canadian Pacific as it appeared at East Pittsburg, where a delegation from the Westinghouse Electric & Manufacturing Company met them.

Two very pretty young ladies dressed in pink presented each lady on the train with carnations, the Westinghouse Band, composed of employees of the company, enlivened their trip with popular airs until they reached the Union Station.

A handsome album containing scenes en route was presented to each member by the Westinghouse Electric & Manufacturing Company. Song books were also distributed. The General Electric Company also presented each of the travelers with a most tastefully gotten up leather-bound booklet containing views of natural scenery and industrial plants along the route.

The master of transportation of this train was Mr. J. C. McQuiston, manager of the Westinghouse Department of Publicity.

"Pink Special."

The personnel of the train was as follows: Past presidents W. C. L. Eglin, Philadelphia, Pa., and Mr. Dudley Farrand, Newark, N. J., Messrs. S. L. Tone and R. S. Orr, vice-president and superintendent, respectively of the Allegheny County Light Company. Among the others were: Messrs. S. L. Nicholson, G. B. Griffin, E. A. Thornwell, G. C. Ewing, B. F. Ott, Van Dusen Rickert, E. E. Gilbert, F. D. Pembleton, A. E. Clifford, J. C. Woodsome, R. E. Hamilton, R. B. Parker, David B. Rushmore, John Mustard, R. E. Moore, D. A. Bertolette, Mr. and Mrs. C. S. Cook, Mr and Mrs. Harry M. Hope, Mr. and Mrs. Farley Osgood, Mr. and Mrs. W. K. Vanderpoel, Mr. and Mrs. M. O. Troy, Mr. and Mrs. Dudley Farrand, Mr. and Mrs. Paul Spencer, Mr. and Mrs. Marlow, Mr. and Mrs. L. E. Sinclair, Miss Jane Eglin, Mr. and Mrs. J. J. Gibson, Mr. and Mrs. John L. Mather.

N. E. L. A. CONVENTION AT SEATTLE.

The Fifth Annual Convention of the National Electric Light Association has been a brilliant occurrence during the past week at Seattle. Commencing on Sunday, when the special trains from the four corners of America began to arrive at the Convention City, there has been a continuous procession of welcomes, bounteous hospitality and technical and commercial meetings.

The six prismatic-hued special trains, each given a distinguishing color, were made up of the finest equipment in operation in America. On all of them the trips were made enjoyable by unique entertainments, elaborate hospitality at the various points en route, and it was invariably a happy crowd which was met at Seattle by the committees in charge.

The Golden Poppy Special, which carried the California delegates, like the rest of the specials, was given right of way over everything on the road and arrived according to schedule. Those who were fortunate to travel by this train all agreed that the trip was the most enjoyable ever taken.

On Monday afternoon, there was a baseball game in which the Pacific Coast team won over the Easterners by a score of 16 to 3. On the evening of that day an elaborate reception and ball was given. The real

work of the Convention commenced on Tuesday morning with an address of welcome by Mayor Cottrell of Seattle. This was followed by the annual address of Presiding Officer John F. Gilchrist of Chicago, after which Mr. Gilchrist introduced Mr. John A. Britton, vice-president and general manager of the Pacific Gas and Electric Company of San Francisco, who delivered an elaborate plea for the recognition of San Francisco in 1915.

In introducing Mr. Britton, the president said:

"All of you know San Francisco, and those of you who have not enjoyed the experience, have heard of her unbounded generosity and hospitality. That is my excuse for calling before you a man from San Francisco who is a director of the Exposition. We understand he has some good message to deliver to us."

Mr. Britton's plea for San Francisco was enthusiastically received and brought the Convention to its feet.

Among the things he said were the following sentences:

"I want to dissociate myself for one moment from my role of delegate, and in assuming that of an officer of the Exposition Company to give you this message: 'San Francisco invites the world in 1915.' In giving you that message, I wish to remind you that San Francisco is representing the entire United States in this commemoration of the greatest engineering feat ever done by man. California is the pioneer, not only in central station development, but also in the hydroelectric transmission development systems to be operated in this country."

He then discussed the potential feature of San Francisco, and especially in connection with the Exposition, giving a description of the many congresses which will be held there in 1915. Finally, he said:

"I care not whether you visit the orange vales of Los Angeles, seek the shelter of the mountains of Siskiyou, or climb the Sierra Nevadas, eventually you will gravitate toward San Francisco, the city on the bay that furnishes the finest harbor in the world, where peace and plenty abound and where we will do all we can for you in 1915. Come, I pray you."

In reply to Mr. Britton's splendid plea, President Gilchrist stated that while at present it was not a time for deciding where the 1915 Convention would be held, he would assure Mr. Britton and the Fair directorate that the request which had been so eloquently presented would be seriously considered.

The general, executive, technical, accounting, commercial power transmission and public sessions commenced immediately following the general addresses, there being three sessions held at 2:30p.m., in which the various reports of committees were made. Three papers were delivered on the general subject of accounting and two papers and several reports made in the technical session.

On Tuesday evening the transmission session was opened by an address by Mr. Henry L. Doherty in a report on "The Use of Electricity for Irrigation and Agricultural Purposes," illustrated by lantern slides and moving pictures. There was also a commercial session at which various reports were presented.

On Wednesday morning occurred the second general session with several papers, also an executive session and the second technical and accounting sessions with several important papers.

Wednesday afternoon the various morning sessions were continued, in which a great deal of work was done, and on Wednesday evening there was a musical program and an illustrated lecture on the "Electrification of the Panama Canal." On Thursday were the concluding sessions of the various departments and a number of papers were given.

Throughout the week the Seattle hosts outdid themselves in the variety and elaboration of entertainment offered. Trips were made to the various hydroelectric plants and to many other interesting points, and much entertainment was offered to the ladies who did not care to attend the various meetings of the Association.

This Convention is conceded to have been one of the most successful ever held by the National Electric Light Association and universal praise is conceded to the Seattle members.

DISTRIBUTION OF POWER FROM LOS ANGELES AQUEDUCT.

Electrical Engineer Scattergood has presented plans for the distributing system of power from the Los Angeles Aqueduct. These plans divide the city into five districts, with an aggregate of 1068 miles. The total cost of an underground system as figured by Scattergood is placed at $16,574,500, while the total overhead system is fixed at $2,868,000.

The underground system estimates the cost of commercial lines and equipment at $12,754,300, and the cost of street lighting at $3,820,200. The overhead system places the commercial lines at $1,618,000 and the street lighting system at $1,250,000.

The districts are designated as 0, 1, 2, 3 and 4. The estimate per front foot for district 0 is 62 cents; for district 1, 66.1 cents; for district 2, 32.6 cents; for district 3, 35.8 cents; for district 4, 34.5 cents.

The districts are as follows: District 0: Beginning at Pico and Flower, on Pico to Wall; Wall to Fifth, Fifth to First, First, to Alameda, and return to San Pedro; thence to the Plaza, thence to New High street, New High to Temple, Temple to Hill, Hill to First, First to Olive, Olive to Fourth, Fourth to Flower, Flower to Pico.

District 1: Beginning at Sunset and Figueroa, on Figueroa to Washington, east to Central avenue, north to Third, east to Santa Fe avenue, north to Center street, north to Brooklyn avenue, west to Sunset and Figueroa.

District 2: Beginning at First and Hoover, south to Adams, west to Vermont, south to Santa Barbara, east to Main, north to Washington, west to Figueroa, north to First, east to Hoover.

District 3: Beginning at Hoover and Pico, west to Western avenue, south to Santa Monica avenue, west to city limits, south to Slauson avenue, east to Main, north to Santa Barbara, west to Vermont, north to Adams, east to Hoover, north to Pico.

District 4: Remainder of city not included in previous districts.

Numerous conferences will be held before the plan is finally adopted.

JOURNAL OF ELECTRICITY
POWER AND GAS

PUBLISHED WEEKLY BY THE

Technical Publishing Company

Rialto Building, San Francisco

E. B. STRONG, President and General Manager
A. H. HALLORAN, V. P. and Managing Editor
ROBERT SIBLEY, Treasurer and Editor in Chief
C. L. CORY, Secretary and Special Contributor
A. M. HUNT, Director and Special Contributor

On Library Cars of all Southern Pacific Trains.

TERMS OF SUBSCRIPTION

United States, Cuba and Mexico	per year,	$2.50
Dominion of Canada	"	3.50
Other Foreign Countries within the Postal Union	"	5.00
Single Copies, Current Month	each	.25

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Changes of advertising copy should reach this office *ten days in advance of date of issue.* New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

Entered as second-class matter at the San Francisco Post Office as "The Electrical Journal," July 1895.
Entry changed to "The Journal of Electricity," September, 1895.
Entry changed to "The Journal of Electricity, Power and Gas," August 15, 1899.
Entry changed May 1, 1906, to "The Journal of Electricity, Power and Gas." Weekly.

FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

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Water Rights on Interstate Streams

Maiandros was a river in Asia Minor. The classic Greeks told of how a hunter by that name chased a beautiful mountain nymph down from the high mountains and just as he was about to overtake her, the gods turned him into the river bearing this name. So circuituous was this mountain course taken by Maiandros in dodging here and there in his passionate pursuit, the name—meander—survives still, written indelibly into our language as signifying a zigzag or rambling course. To the Greek mind the coure of the Maiandros was the superlative of twisting and zigzagging.

We are not told in Indian traditions as to how our Western rivers were supposed to have been formed, but surely if a similar myth existed among them for the formation of the Columbia and its various tributaries, brave and passionate buck must have had many a dizzy turn before fair Red-wing was released in her flight at the entrance to the great Pacific.

Take, for instance, the waters of Silver Bow Creek, rising just east of Butte, Montana. In passing westerly through Montana this creek becomes the Deer Lodge, Hellgate, Missoula and Clark's Fork rivers. Under the latter name it drains into Lake Pond O'Reille in Northern Idaho. We next find the same waters journeying up into Canada, only to return into this country as the Columbia River, now wholly within the State of Washington, but later serving as the boundary line between Washington and Oregon. It may be remarked also in passing that countless smaller tributaries of the Columbia may be diverted from one State into another.

As the States through which these waters drain are semi-arid in character, the laws governing interstate streams are of vital interest.

A digest of the court decisions, many of which appear on another page of this Journal, and among which are cited several from our highest national tribunal, leads to five definite conclusions regarding water rights on interstate streams, as follows:

1. With the single exception of navigable streams the state and not the nation has jurisdiction over waters.

2. Regarding two appropriators, each situated on the same stream but in different states, wherein the doctrine of appropriation is upheld in both, priority of appropriation will be upheld regardless of state lines.

3. Regarding two appropriators, each situated on the same stream but in different states wherein either one or both states still adhere to the doctrine of riparian rights, the water will be distributed on an equitable basis, according to facts without considering priority of appropriation.

4. Regarding the rights of two states through which the same waters drain, the waters will be distributed on an equitable basis according to facts.

5. States may forbid by legislative action the taking of waters into other states. Without such legislation, however, waters may be conducted from the state.

Idaho at its last legislative session had up for consideration the forbidding of taking waters without the bounds of the state. Oregon passed a give and take or reciprocity law, while California, pursuing a narrow-minded policy passed a law forbidding the taking of waters without the state.

The distribution of waters of the West, like most of the other affairs of life, should be made on the

most liberal principles. Concerted action among the western states on a give and take basis is absolutely necessary for greatest good to all. It is to be hoped that other western states will soon follow the far-sighted policy inaugurated under Oregon's splendid water system and that California may soon come to its senses both as to diverting waters from the state and also as to adopting through liberal views of the courts the appropriation doctrine rather than the time dishonored system so far as western need are concerned—of the riparian doctrine.

New Coinage an Economic Necessity

Thos. N. McCarter, president of the American Electric Railway Association, in a recent after-dinner speech at the Palace Hotel in San Francisco forcefully summarized the three predominating evils or wrong viewpoints in the public mind that must be adjusted at once or stagnation and even possible chaos and dissolution may result to our great transportation companies of America. The most prominent of these three was shown to be the continual extension of the 5c fare limit in our city street railways with its ever-increasing transfer range.

Now comes the proposal to coin three-cent pieces and also a smaller unit to be known as the one-half cent piece. A bedlam of protest greeted this measure at its incipiency. The traction companies feared that when the coins became a reality the populace the country over would demand a three-cent car fare. The telephone company foresaw every nickel-in-the-slot machine bedecked with coins of the wrong denomination. And even the West—the dear old West—saw the possibility of one of its dearest traditions being swept away—that tradition which built up from bountiful days of forty-nine, makes the holder of each pocket book disdain the carrying or computing of accounts less than even multiples of 5c pieces.

As to the last argument, the gigantic commercial era now before the West has swept away this false hand-me-down of Western greatness and liberality, or if not entirely so it should. The economic age now upon us demands its abolition.

It appears that the telephone companies have nothing to fear from this new coin. It is said that the first thing the director of the mint, George H. Roberts, did after the proposed legislation was submitted to him for opinion, was to urge that the language of the bill be so shaped that the treasury could make the coin wholly unlike, in size and design, any existing coin. The design now most favored by the treasury is much too large to enter a dime slot, too small to operate a nickle slot and possesses a scalloped edge like an Indian one cent piece.

As to the protest from the traction companies regarding a three-cent fare, surely a rational, reasonable people will never unjustly demand the death of a prosperous, promising industry. This is an age of economy, an age of regulation and we believe in fair play. The rate question in the large city traction companies is indeed one of many complications and one that has been grossly mistreated and warped out of shape by both parties to the issue. After all the fundamental consideration is that of cost of service. If a careful investigation in any particular case should show that after allowing for interest, depreciation and all other operating expenses in spite of a reduction to a 3c or 4c fare, the earning on the securities can still be made to pay such a reasonable return that we would advise those nearest and dearest to us to invest their money in these securities, then by all means this should be done. On the other hand in communities where topographic features and other conditions are such that 6c is similarly necessary, then it is only reasonable that 6c should be charged. Both the traction companies and the people should forget the magic 5c piece, for it isn't magic.

It would seem that the traction systems have grown to such enormous proportions in our greater cities a zone system of charges should be made based solely upon cost of service from centers of distribution in these great municipalities. Simply because Los Angeles has had the nerve to extend its city limits by means of the shoe-string addition some sixteen miles westerly to the sea is no reason why the cost of service on a street railway over this sixteen miles should be but five cents. The zone system of charges seems to be the only rational method and to its careful study our great traction companies and the regulating commission should give most careful consideration. This consideration should be one absolutely independent of the 5c traditional coin handed down to us from an age wholly different from the present.

Electrical Education in 1915

The plea made by Mr. John A. Britton at the opening session of the National Electric Light Association in Seattle this week in which he mentioned California's supremacy in the development of electric power and transmission has really a far greater significance than may have been conceived, even by so brilliant a talker as he.

San Francisco is indeed a hub for the enormous potential activities of the Pacific Coast and it was to this city the first long-distance transmission system was developed. Every branch of electrical engineering practice may be observed and every step of the history of its development has been exemplified in the transmission systems connecting with the electrical supply of San Francisco.

The World's Fair in 1915 will far outshine in magnificence of display anything that has been heretofore conceived and it is all through the possibilities of the wonderful resources which have had their development in California. And the whole world has reason to expect such an exhibition, just as it might expect France to excel in silk textile exhibits, Persia in oriental tapestries, Germany in military organization, or Brazil in coffee and rubber. California can, however, go a step further, because while these various features of excelling are due more or less to local or sectional advantages, the development of the transmission and use of electricity is worldwide. Nevertheless, California keeps always ahead, her engineers answer the demand and fulfill the need without fear or favor. The world's greatest commercial science development will be found here in 1915.

PERSONALS.

J. T. Shaw, the telephone expert of the State Railroad Commission, visited Los Angeles during the past week.

W. S. Berry of Western Electric Company, has been enjoying a visit from his mother, Mrs. W. W. Berry.

H. V. Carter, president of the Pacific States Electric Company,, recently returned from an extensive eastern trip.

C. W. Hinchcliffe, who is now associated with independent telephone interests in Arizona and New Mexico, is at San Francisco.

E. V. D. Johnson, manager of the Northern California Power Company, spent the past week at Redding on an inspection trip.

Carlos De Muro, sales agent of the General Electric Company at Vera Cruz, Mexico, is visiting the Company's San Francisco office.

Chester H. Pennoyer, head of the National Conduit and Cable Company of California, has been confined to his home for more than a week.

Hunt Chipley of New York, counsel for the American Telephone and Telegraph Company, and Mrs. Chipley, are visiting San Francisco.

F. A. Richards, manager of the car department of Pierson, Roeding & Co., is spending a vacation in the Yosemite Valley, accompanied by Mrs. Richards.

C. B. Zabriskie, vice-president and treasurer of the United Properties Company. with headquarters at New York, is visiting the San Francisco office of the corporation.

H. L. Jackman, manager of the Western States Gas & Electric Company's Humboldt County interests, arrived at San Francisco from Eureka, during the past week, on his way north.

W. J. Davis Jr., Pacific Coast engineer for the General Electric Company, has just returned to San Francisco after visiting the works at Schenectady and spending a month in the East.

John S. Baker, district manager of the Crocker-Wheeler Company, spent the past week at Los Angeles, where an office was recently opened. **J. E. Fries,** Pacific Coast engineer, was at the San Francisco office during the absence of his chief.

H. A. Barre, chief electrical engineer of the Pacific Light and Power Company, is lying critically ill in a Los Angeles hospital. He submitted to an operation after breaking down with stomach trouble, while out on a survey for a new power line some time ago.

George H. Throop, engineer in charge of the valuation work undertaken by J. G. White & Company of New York for the San Joaquin Light & Power Corporation, has closed the Fresno office as the field work is completed, and removed his force to the Los Angeles office, where the data obtained will be worked up.

T. J. Pace, head of the arc light division of the Westinghouse Electric and Manufacturing Company of East Pittsburg, and **A. A. Brown,** assistant to the company's sales manager, with headquarters at New York City, spent a few days at San Francisco while en route to Seattle to attend the annual convention of the N. E. L. A.

C. A. S. Howlett, president of the National Sales Managers' Association, who is connected with the General Electric Company at Schenectady, was the guest of the San Francisco division for several days last week, while on an official visit to the Pacific Coast branches of the organization. On Thursday night Howlett was the guest of honor at a banquet at a cafe, where he addressed the local division on "The Importance of the Sales Department."

J. R. Freeman, a prominent consulting hydraulic engineer, who was retained by the city to make a report on the Hetch-Hetchy water project to the U. S. Army engineers, has arrived at San Francisco from the East. He has had his engineers on the ground for some time and they are now finishing the details of his plan. Freeman's report will be made up from data gathered by these engineers and from his own inspection of the water supply. It will be turned over August 1st to the Government officers.

STATE ELECTRICAL CONTRACTORS' ASSOCIATION.

H. C. Reid, manager of the electrical department of the Pacific Fire Extinguisher Company, is at Portland on business.

Bids have been received by the Board of Public Works from the various contractors for the electrical construction work on the car house for the Geary-street municipal railway, which is to be erected at an estimated cost of about $250,000. There were three separate propositions on the electrical work, including the wiring and switchboard for the lighting system of the car barn. The bids ran from $10,000 to $15,000, but no award has been made.

Bids have been taken by the United States Quartermaster's Department for the new feed wires for the electric system at the General Hospital at the Presidio, San Francisco. The bids were as follows: Newberry Bendheim Company, $9545; Butte Engineering Electric Company, $9693; the John G. Sutton Company, $10,058; Standard Electrical Construction Company, $10,257; Turner Electrical Company, $10,220; McFell Electric Company, $10,495; Central Electric Company, $11,289. The bids have been forwarded to Washington, D. C.

ENTERTAINMENT OF THE RED SPECIAL TO THE N. E. L. A.

The Electrical Development League of San Francisco did itself proud in the entertaining during the past week of the New York delegation to the N. E. L. A. which has just concluded its sessions at Seattle.

From the time that the Secretary of the League boarded the train in Southern California to the final farewell as the train sped out from San Francisco to the North, there was something doing and something enjoyable for the guests every minute. The official program of entertainment began at 9 o'clock Thursday morning, June 6th. Ample automobiles were found in waiting at the St. Francis Hotel to convey the entire visiting delegation to the Exposition grounds and other points of interest in the Golden Gate City. An enjoyable forenoon thus ended at the Cliff House, where a delicately provided luncheon awaited the guests.

The reception committee having in charge the entertainment of the guests was composed of the wives of local men interested in the N. E. L. A. were as follows: Mrs. W. W. Briggs, chairman; Mrs. S. J. Lisberger, Mrs. F. H. Varney, Mrs. E. B. Strong, Mrs. Berry, Mrs. A. H. Halloran, Mrs. Robert Sibley.

After the luncheon at the Cliff House the guests were then provided with automobiles to be at their disposal for any purpose they desired throughout the afternoon.

The evening affair at the St. Francis was unique and full of ginger from start to finish. The Oriental and picturesque sight of dainty Chinese maidens sprinkling flowers among the guests was the starter, then followed some twenty Chinese boy musicians, American born, who by the rendering of such patriotism arousing songs as "America" and "Star Spangled Banner" brought the guests to their feet a number of times. Comedians and songsters followed in rapid succession. Tait's entertainers furnished by the courtesy

of the Tait-Zinkand Cafe, made the hit of the evening in their "Song to Lillibridge and Others," which is as follows:

National Electric Light Association you for me
To you I give a toast,
And it goes without saying
You're more than welcome to the Pacific Coast.
There's Mr. Elliott of New York,
To his right Mr. Hodskinson of Boston does sit,
But if you asked Brown of Chicago
To do you a favor
He'd say, "Let George do it."
So let us drink to Geo. Elliott
And of New York may he always boast,
And as Hod has BEAN to Boston
To him I give a toast

There's one more man I wish to mention
And Brown of Chicago I have in mind
And as all our friends leave San Francisco
May they build a Lilly bridge behind.
National Electric Light Association you for me,
To you I give a toast,
And it goes without saying,
You're more than welcome to the Pacific Coast
Now Sanford says Electricity is measured by Watts
And us he easily convinced.
But Dick still insists that it is measured by inches.

Now of Dayton I will sing and
I don't want anyone to laugh
For from old Ohio comes our beloved President Taft.
But take the letter "F" out of the word "Taft"
And you're more up-to-date,
Put an "I" in its place
And another great man we have
From Dayton who is Tait.

The evening closed resounding with the warm words of welcome of John A. Britton, representing the Electrical Development League of San Francisco, and the wholehearted response by F. M. Tait, vice-president of the N. E. L. A.

In detail, the entertainment of the evening was as follows:

Orchestra Selection .....
Welcome by Chinese Flower Girls.....
Young Arow Club .....(Chinese Band Parade)
Newman & Decorsey .....(Songs and Sayings)
Tait's Entertainers .....(Courtesy Tait-Zinkand Cafe)
Norris Children .....(Dutch Songs)
William O'Brien .....(Tenor)
Alma Tuchler .....(Recitations)
Dan Casey .....(Songs and Jokes)
Lillian Byrnes..... (Songs)
McKensey & Aguire .....(Comedians)
Joe Eckstein .....(Character Impersonations)
Address of Welcome .....John A. Britton
Reply.....F. M. Tait, Vice-President N. E. L. A.
San Francisco—Alex T. Vogelsang, Chairman Public Utilities Committee, San Francisco Board of Supervisors.
Au Revoir .....Geo. C. Holberton

On Friday morning the guests were taken to Mt. Tamalpais on the famous "Crookedest Road in the World." The Red Special left for the North with its guests at 7:20 in the evening. The days in California, so declare the visiting guests, will long remain a bright spot among memories, golden treasures.

TRADE NOTES.

Complete Allis-Chalmers electric motor equipment, for opening a sawmill at San Leandro, has been sold to the Hudson Lumber Company.

The Allis-Chalmers Company has sold the Standard American Dredging Company two steam turbines of 400 kw. and 500 kw., respectively.

The Pacific Gas & Electric Company is planning the construction of a new substation at Woodland to take care of the increased load in that developing territory, where there is great activity in electric railway projects.

The Dow Pump Company is making plans to erect a million-dollar plant in San Francisco for the manufacture of what is termed the improved Diesel engine. So great is the promised demand of this celebrated engine that the promoters of the plant here feel every assurance of the success of the proposed venture.

George J. Henry has just shipped a water wheel with a driver compressor to Angels for use in connection with the Sierra & San Francisco Power Company's dam on the Stanislaus River. The wheel is made heavy so as to act as a flywheel in driving an air compressor.. Contracts will soon be let for the construction of the new impounding dam.

Ashley & Kaufman, consulting engineers of New York, have opened permanent offices at 14 International Amphitheatre, Union Stock Yards, Chicago, Ill. Mr. John Fallon formerly of the Tennessee Copper Company will be resident engineer and in charge of the office. They have been retained as consulting engineers on the heating, lighting and sanitary engineer for the Union Stock Yards and Central Manufacturing District.

The General Electric Company has sold to C. C. Moore & Co., who have the general contract, two steam turbines, which will be installed in the power plant of the C. A. Smith Lumber and Manufacturing Company at Marshfield, Ore., mentioned in these columns last week. The usual accessories and switchboards are included. The generating units are described as follows: One A. T. B. 4, 2000 kw. (2500 k.v.a., .8 P.F.) 1800 r.p.m., 2300 v., horizontal condensing mixed-pressure Curtis steam turbine; one A. T. B. 2, 500 kw. (625 k.v.a .8 P.F.) 3600 r.p.m., 2300 v., horizontal, condensing, high-pressure Curtis steam turbine.

The General Electric Company has secured the contract for a great variety of electrical machinery for the Alaska Gastineau Mining Company. The largest item is a 1750 k.v.a. water-wheel type generator, 3-phase, 60-cycle, 2300 v., at 257 r.p.m., which is to be direct-connected to a water-wheel built by the Yuba Construction Company. Also, one A. T. B. 12, 1200 kw., 600 r.p.m., 3-phase, 60-cycle, 2300-v., belt-driven generator; one commutating pole, 45 kw., D.C.. generator; one 35 kw. motor generator set, consisting of one 550-volt commutating-pole generator, direct-connected to one 50-h.p., 2200-v., 3-phase induction motor; also a 75 kw. motor-generator set of same type; three 1250-k.v.a. transformers, for stepping from 22,000 to 2300 volts; some smaller transformers and complete switchboards for the above apparatus are also included.

INSULL BANQUET.

Samuel Insull of Chicago, who was recently made a director of the Pacific Gas and Electric Company, was the banquet guest of the district managers and heads of departments of that corporation at the Fairmont Hotel on Friday night.

John A. Britton, vice-president and general manager, presided, and introduced the guest to the ninety-five officials of the company with an interesting speech. In the course of his address, Mr. Insull referred to the Pacific Gas and Electric as one of the best-organized corporations in the West.

Stereopticon views were exhibited showing the power plants and other prominent features of the company's system. An elegant souvenir menu was issued with brief statistical information and local hits following each service of the banquet. The slogan was: "San Francisco knows how—with the help of Pacific Service—1915."

NEW APPLICATIONS FOR ELECTRICAL INSPECTOR.

New and improved specifications for rubber-covered wires and cords, as printed under Rule 50 in the 1911 edition of the National Electric Code, call for a product passing new electrical, physical and chemical tests designed to secure a better quality of insulation than previously prescribed.

Supplies of wire made according to the new specifications are now available, and the old label, printed on a yellow background, was discontinued January 1, 1912.

Wires shown by tests and examination conducted by Underwriters' Laboratories to be in accordance with the new specifications will have a label printed on a red background attached to each coil.

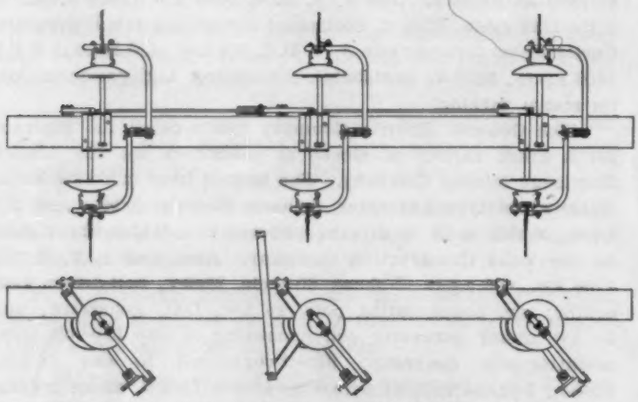
After July 1, 1912, the use of unlabeled wire or wire bearing the old discontinued yellow label will not be allowed.

WM. J. NIXON,
Chief, Department of Electricity, San Francisco, Cal.

INDUSTRIAL

K. P. F. DISCONNECTING POLE TOP SWITCH.

The illustrations herewith show the very latest type of high-tension disconnecting switches as manufactured by the K. P. F. Electric Company, 37 Stevenson street, San Francisco. Each 22,000 v. unit or pole is arranged to be supported on the standard single cross arm (6 x 6) in place of a regular line insulator. The strain of the line wire is carried through the switch itself, obviating the use of dead end insulators or double cross arm construction.



K. P. F. Disconnecting Pole Top Switch.

The switch consists simply of two suspension type strain insulators fitted with central pins and iron caps, one element fixed and the other rotatable about the axis of the pin.

The line wires are dead-ended onto the two caps, one of which supports an arm carrying a knife blade and the other a pair of jaws through which the circuit is made and broken.

A crank or lever fastened to the pin of the rotating insulator provides means for opening and closing the contacts.

As the supporting fixture is normally to be grounded the operating mechanism, arranged for single poles separately or three together, can be handled with safety.

The switch designed is for use on voltages of 6600, 11,000 or 22,000, when a single insulator is used, but can be operated on any commercial voltage by the addition of insulators in series.

ELECTROLYTIC LIGHTNING ARRESTER FOR RAILWAY SERVICE.

The protection of electrical apparatus from lightning and other high voltage static disturbances necessitates the use of a device that will relieve the abnormal pressure due to the static change and divert it from the susceptible windings of the machines into the ground.

It is not sufficient that the abnormal pressure be instantly relieved, but to prevent damage absolutely, the voltage at the machine should be prevented from rising abnormally. To accomplish this result, the protective device must (1) begin to operate at pressures well within the breaking-down point of the insulation on the apparatus; (2) permit the enormous though very brief current of the static charge to pass instantly, as any delay in the passage of the charge causes a rise in pressure. A third requirement is that the protective device shall prevent a power current or arc from following in the path of the static discharge, as soon as the abnormal condition has been relieved. These conditions are particularly important in the protection of railway and other low voltage apparatus.

Lightning arresters of the spark-gap type possess the disadvantage, particularly for low-voltage work, that the voltage must rise to several times normal before the discharge occurs. Thus, with arresters having an equivalent spark gap as low as one-tenth of an inch, the voltage must rise to 4000 or more during discharge, while a comparatively high resistance in an arrester causes a choking effect on the static charge which tends to allow the voltage to become considerably high before full relief is afforded. These features account for the cases of lightning damage in spite of spark-gap type arrester.

The ideal lightning arrester for low-voltage circuits is the electrolytic type. This type of arrester has two essential characteristics, due to a film of hydroxide of aluminum deposited on aluminum plates or trays, that enable it perfectly to fulfill the conditions required. These essential characteristics are: (1) that it automatically offers a very high resistance to currents at normal voltages and a very low resistance to currents above a certain critical voltage; and (2) that it posseses the properties of a condenser, offering high effective resistance to currents at low frequency, and low effective resistance to currents at the high frequencies that are prevalent in lightning discharges.

The decrease in resistance occurs very rapidly at a certain critical voltage, so that for currents at double the normal voltage, the film offers practically no resistance to the flow of current, but when the excessive voltage ceases, the resistance is instantly restored and no power current follows the discharge nor is there any arcing.

A design of an electrolytic arrester for railway work has recently been placed on the market by the Westinghouse Electric & Manufacturing Company, East Pittsburg, Pa., built in two styles, for 600 and 1500 volt circuits.

The arrester consists of a tank of oil in which are placed, on properly insulated supports, a nest of cup-shaped aluminum trays. The spaces between the trays are filled with electrolyte, a sufficient quantity for one charge being furnished with each arrester. The top tray is connected with the line through a 60-ampere fuse, and the bottom tray is connected to the tank which is thoroughly grounded by means of a lug. A fuse of the enclosed type is mounted on the cover of the arrester.

A small charging current flows through the trays continuously and keeps the films on the trays built up, so that no charging is required. This charging current is not, however, of sufficient value to raise the temperature appreciably.

The effectiveness of a lightning arrester is largely affected as explained above, by the resistance it offers to the discharge, and in an electrolytic arrester this depends on the area of the aluminum plates. It should, therefore, be borne in mind that the degree of protection is largely dependent on the aluminum plate area, while the integrity of the arrester under hard service and varying line voltage demands large thermal capacity and radiating surface in order to prevent any temperature rise.

The Westinghouse type A arrester is built with ample immersed plate or tray surface, using the same trays employed in the high voltage alternating-current arresters. The immersed area of each tray is 100 square inches, which is over twice as large as that in any other direct-current arrester of this type. The shape and the arrangement of the trays is such that any gases generated by the discharge can pass out readily without disturbing the electrolyte between the trays. The volume of oil and cooling surface are also correspondingly large, rendering this type a large substantial arrester for connecting to bus-bars in direct current plants and giving thorough protection to power apparatus and meters.

NEWS NOTES

INCORPORATIONS.

LOS ANGELES, CAL.—Los Angeles Dry Battery Company; capital stock $25,000; subscribed $500. Directors Fritz Heine, Carl Jaeger, Elmer E. Morgan, Albert Erickson, Carl Pressel.

ILLUMINATION.

LEWISTON, IDAHO.—The Pacific Power & Light Company will rebuild its gas plant in East Lewiston at a cost of $50,000. The company recently extended their system to Lewiston and Clarkston, making a larger plant necessary.

ASTORIA, ORE.—The Elk Creek Light & Water Company has been organized by Orrin Kellogg, O. J. Kraemer and Lester W. Humphreys, with capitalization of $5000, to construct and operate a water system and power plant at Elk Creek.

BELLINGHAM, WASH.—The Whatcom County Railway & Light Company has asked the city permission to bring its high power line from Sumas through the city streets, in order to be in position to furnish power to the Skagit County interurban line.

EUGENE, ORE.—The Oregon Power Company has started preliminary plans for the development of 12,000 to 14,000 h.p. on the MacKenzie River at Martin's Rapids. Probably $1,000,000 will be expended in the work. This company succeeds to the rights and property acquired by the Northwestern Corporation.

TRANSMISSION.

SANTA BARBARA, CAL.—The Coalinga Water & Electric Company has asked for a blanket franchise for the use of the public roads in Santa Barbara County for the distribution of electric power.

EUGENE, ORE.—Plans for the development of 12,000 to 14,000 horsepower at Martin's Rapids on the McKenzie River 33 miles east of Eugene, are being made by the Oregon Power Company. Probably a million dollars will be required to develop the project.

SAN FRANCISCO, CAL.—The San Joaquin Light & Power Company has filed an application with the State Railroad Commission for a certificate of public convenience and necessity to enable it to enlarge its distributing facilities. The company proposes to construct an additional transmission line for the purpose of augmenting its supply in the oil districts of Coalinga, Midway, Lost Hills, McKittrick and the Kern River fields. The corporation states that there is an increasing demand in these sections for power and that it desires to meet it. It is stated also that the new lines would enable the company to sell power to agricultural districts which are now without the service.

TRANSPORTATION.

POMONA, CAL.—The first work of electricizing the Covina branch of the Southern Pacific commenced June 1.

SAN JOSE, CAL.—The San Jose Terminal Railway has been granted a franchise to operate an electric railroad on Second street.

RIALTO, CAL.—Citizens will raise $25,000 for purchasing the right-of-way for a new electric line which the Pacific Electric will build from Upland to San Bernardino.

STOCKTON, CAL.—The State Railroad Commissioners have granted the Stockton Terminal & Eastern Railway permission to issue $65,000 bonds. The road is incorporated to run from Stockton to the town of Jenny Lind in Calaveras County, a distance of 30 miles. The line has been constructed and is in operation from Stockton as far as Fine, a distance of 15 miles, over which trains have been running since September, 1910. Steam service has been succeeded by gasoline motor cars, and the company plans ultimately to operate by electricity. The proceeds of the bond sale are to be devoted to the discharge of obligations to the amount of $26,925.32, and for extensions and improvements. The Commission issued a statement in granting the permismission, in which it goes on record as warning the investing public that the commission guarantees on bonds, stocks or other securities which it authorizes.

TELEPHONE AND TELEGRAPH.

EL PASO, TEXAS.—Improvements to be made by the Mountain States Telephone & Telegraph Company in Downey, Arizona, will involve an expenditure of $35,000.

ASTORIA, ORE.—Secretary Bennett of the Clatsop Cranberry Company has arranged with the local telephone company to install a complete metallic service between Astoria and Clatsop which will serve the residents in the immediate neighborhood of the cranberry marshes.

SAN FRANCISCO, CAL.—At the request of the Supervisors' telephone rate committee, P. H. Coolidge, general commercial superintendent of the Pacific Telephone Company, has filed a statement of the gross toll business between this city and Oakland. Calls originating in San Francisco exceed those from Oakland in terms of revenue by $22,262.32. The toll business from this city to Oakland in 1911 was $135,855.77, and from Oakland to this city $113,593.45. At a recent rate hearing the telephone company was accused of failing to give San Francisco credit for the large outgoing toll business.

PHOENIX, ARIZ.—Application for a receiver for the Overland Telephone & Telegraph Company has been filed in the Superior Court by the Pacific States Electrical Company of San Francisco. According to the plaintiff, the assets of the Overland are about $435,000. Its liabilities are not totaled, though a long list thereof is given. Counting $500,000 worth of bonds, the debts of the corporation are over $700,000. The Overland's assets consist of a complete system in Phoenix, Tempe, Mesa and Jerome, with smaller systems in several other northern Arizona towns; also several hundred miles of toll lines.

WATERWORKS.

LOS ANGELES, CAL.—San Pedro Water Company has offered to sell to the city its plant at San Pedro.

PASADENA, CAL.—The City Council has passed a resolution for municipal water works, the estimated cost to be $1,250,000.

TACOMA, WASH.—The county commissioners have granted a 25-year franchise to the Crystal Springs Water & Land Company to lay a pipe line around Lake Steilacoom, for the purpose of furnishing drinking water to residents of that section.

SALMON, IDAHO.—The contract for the construction of extensions and improvements of the Salmon City water plant, now the property of the city, has been awarded to the Vogler Plumbing & Heating Company of this city for the entire work on its bid of $24,250.

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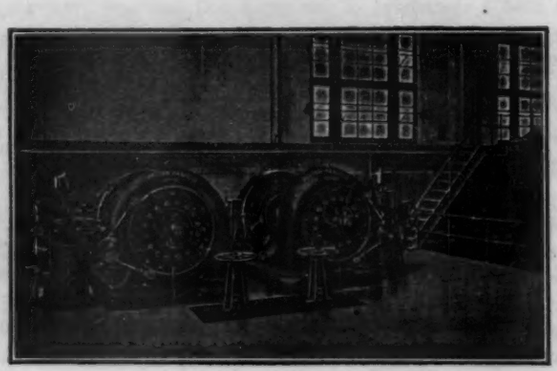

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